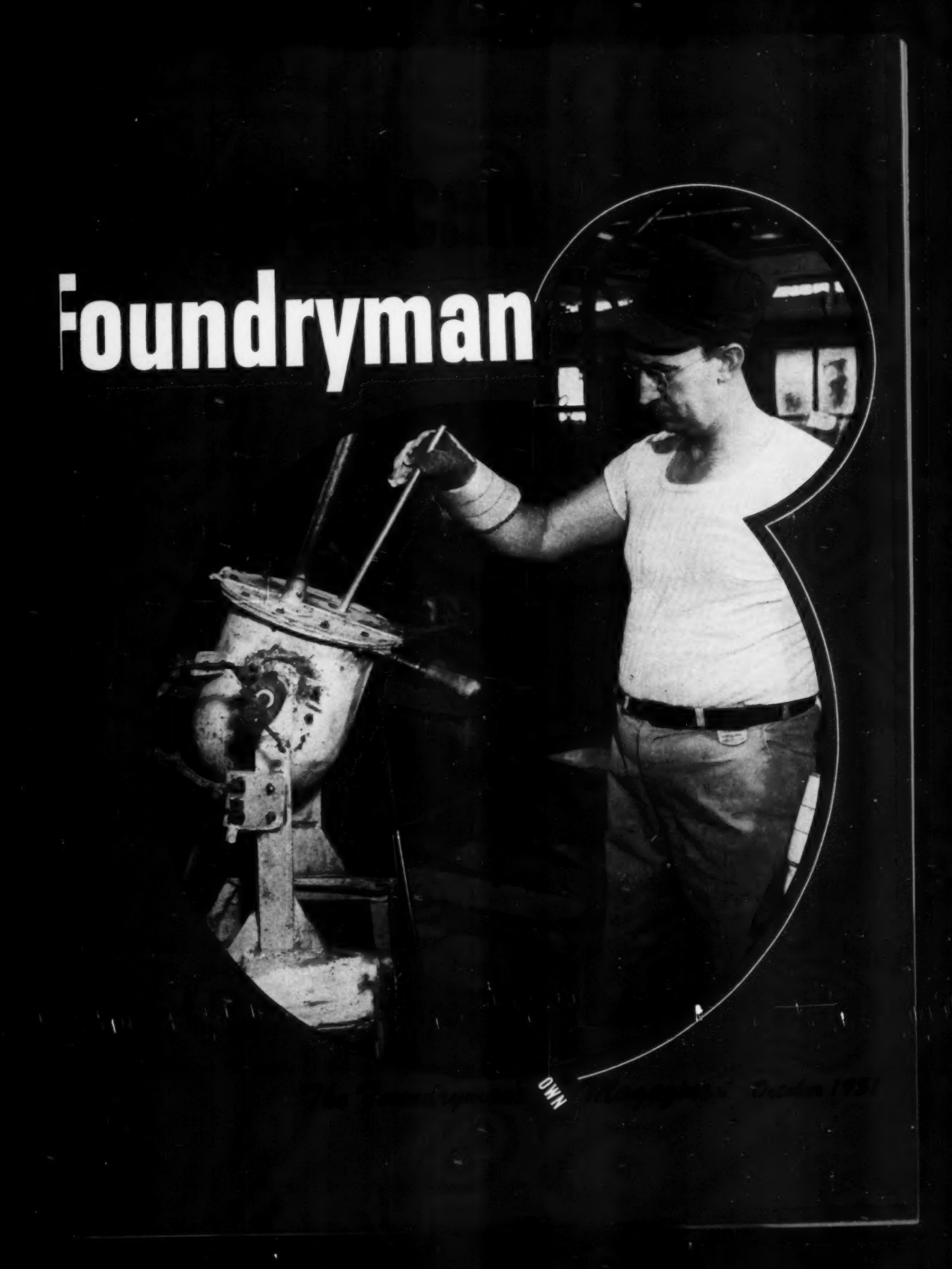
Foundryman



Lectromelt
RAISED THE ROOF
and electric arc melting COSTS CAME DOWN

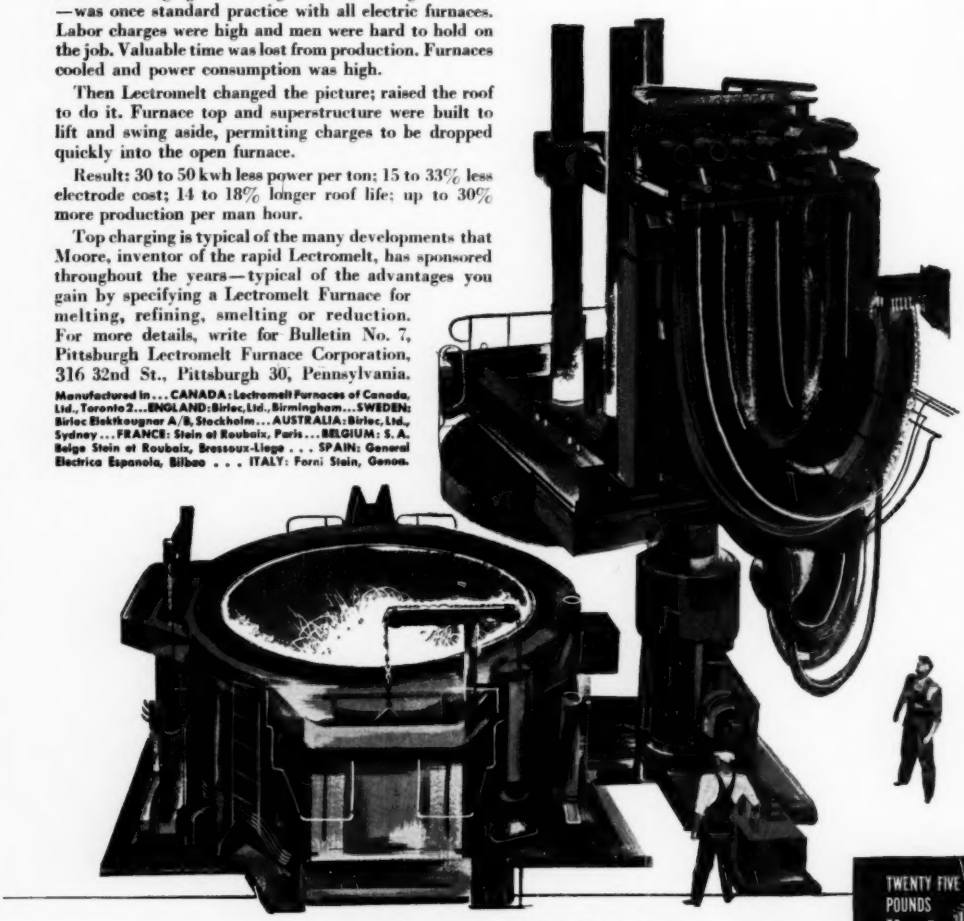
Machine charging—shoveling materials through the door—was once standard practice with all electric furnaces. Labor charges were high and men were hard to hold on the job. Valuable time was lost from production. Furnaces cooled and power consumption was high.

Then Lectromelt changed the picture; raised the roof to do it. Furnace top and superstructure were built to lift and swing aside, permitting charges to be dropped quickly into the open furnace.

Result: 30 to 50 kwh less power per ton; 15 to 33% less electrode cost; 14 to 18% longer roof life; up to 30% more production per man hour.

Top charging is typical of the many developments that Moore, inventor of the rapid Lectromelt, has sponsored throughout the years—typical of the advantages you gain by specifying a Lectromelt Furnace for melting, refining, smelting or reduction. For more details, write for Bulletin No. 7, Pittsburgh Lectromelt Furnace Corporation, 316 32nd St., Pittsburgh 30, Pennsylvania.

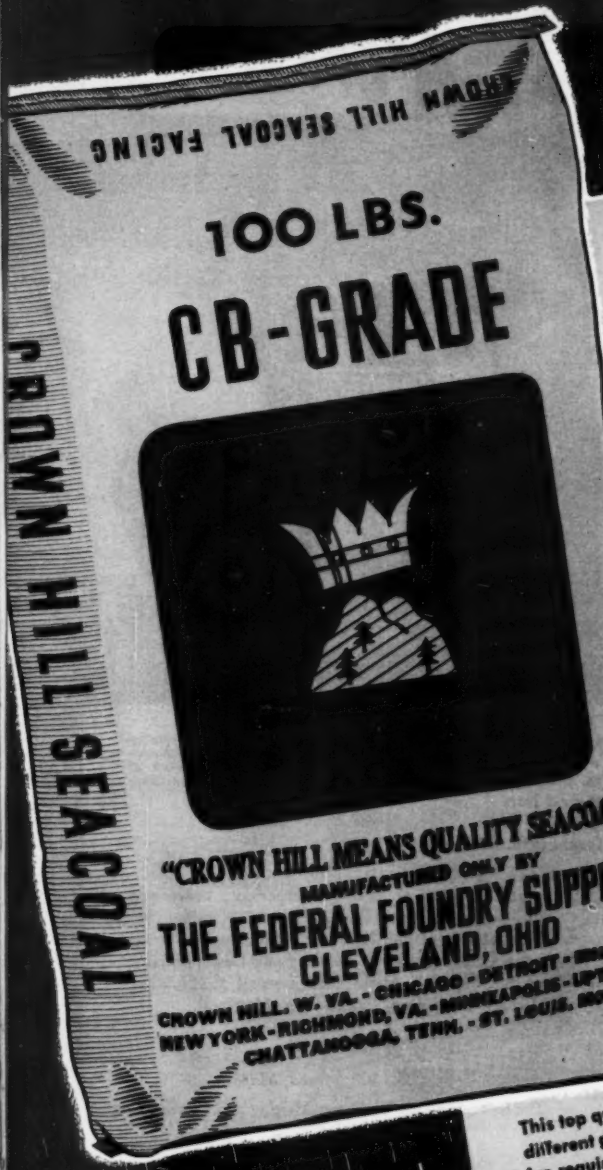
Manufactured in... CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2...ENGLAND: Birlec, Ltd., Birmingham...SWEDEN: Birlec Elektrougnar A/B, Stockholm...AUSTRALIA: Birlec, Ltd., Sydney...FRANCE: Stein et Roubaix, Paris...BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege...SPAIN: General Electrica Espanola, Bilbao...ITALY: Forni Stein, Genoa.



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CROWN HILL MEANS *Quality* SEACOAL



FIGURES FROM BUREAU OF MINES, DEPT. OF INTERIOR OF THE U. S.

(Moisture Free)

PROXIMATE ANALYSIS

Volatile Matter	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS

Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	6.6%
Sulphur	.7%
Ash	3.7%
	100.0%

Fusion Point of Ash 2980° F



The quick-flash coal used in producing CROWN HILL comes from the heart of the West Virginia bituminous coal region.

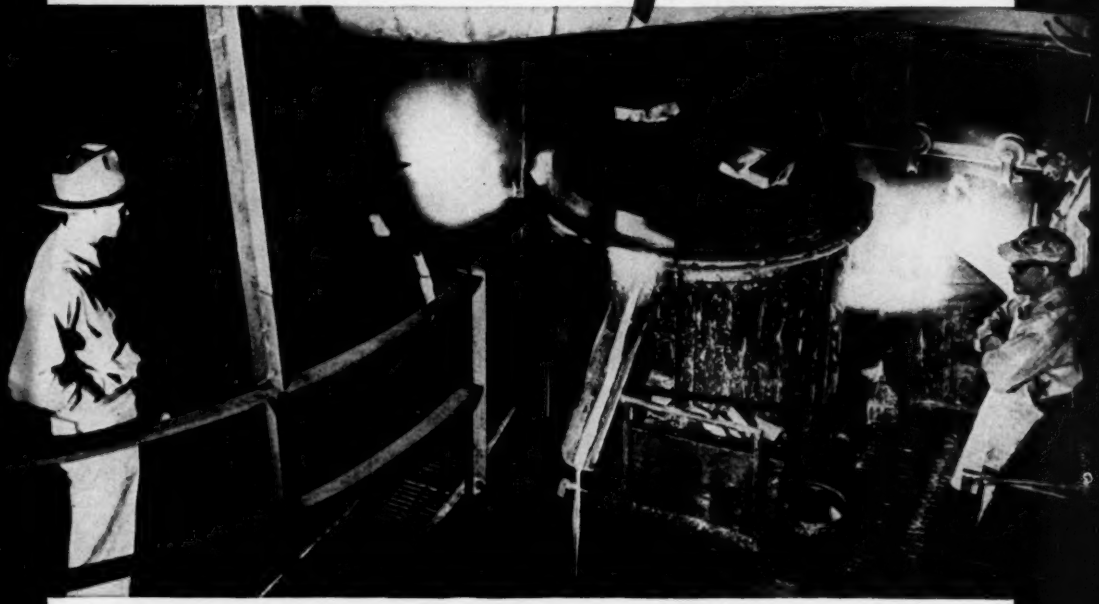
This top quality coal is carefully pulverized and screened into seven different grades. So, you're sure to find a grade to meet your particular requirements. Its quick combustibility induces faster escape of gas and steam. For lower cleaning costs and better finish—always specify CROWN HILL.

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OCTOBER, 1951

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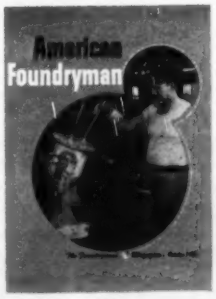
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The American Foundrymen's Society is not responsible for statements or opinions advanced by authors of papers in its publication.



Cover photograph shows one of the steps in precision investment casting at Haynes Stellite Co., A Division of Union Carbide & Carbon Corp., Kokomo, Ind. Operator is melting pigs in a small indirect-arc furnace which pours directly into mold—which is consequently clamped to furnace top—when whole assembly is inverted.

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WRITE FOR BULLETIN NO. 46-B

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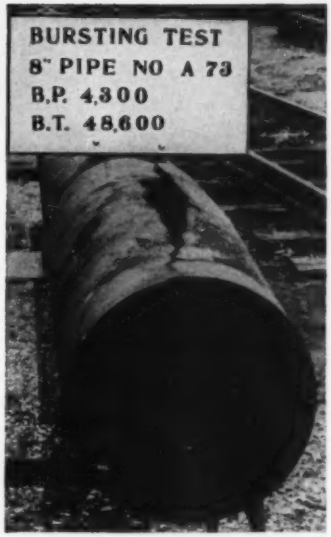
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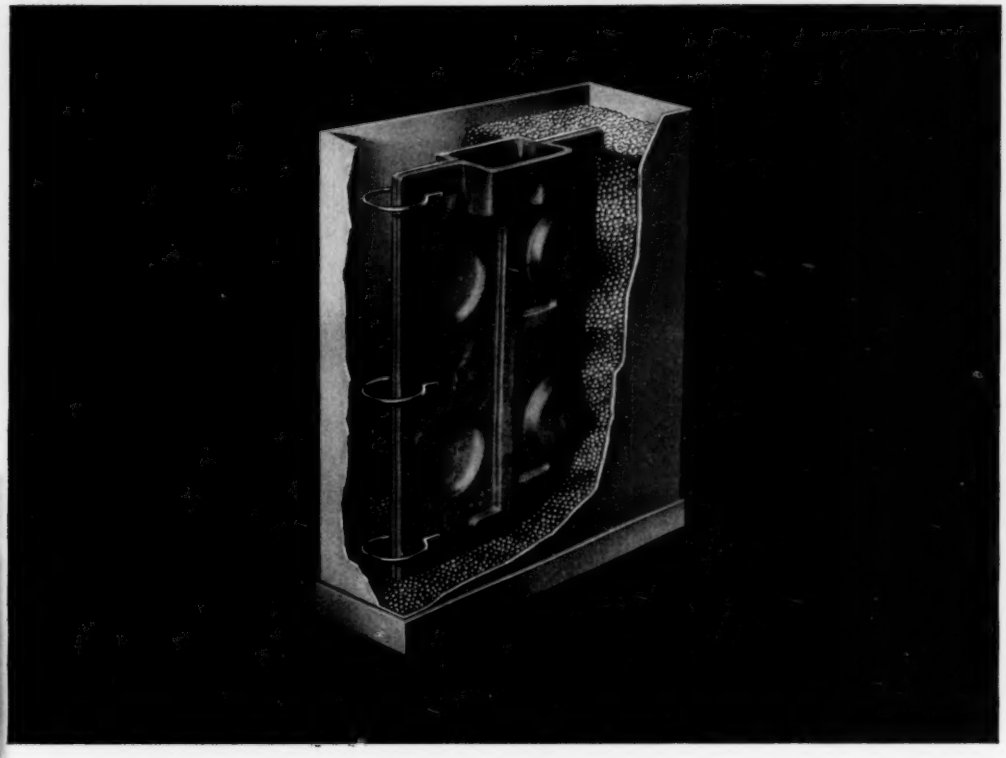
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HY-TEMP REFRACTORY BRICK PAT. NO. 2567088 REFRACTO

HY-TEMP BONDING CEMENT PAT. NO. 2567088 REFRACTO

CASE HISTORY NO. 133

During the early stages of our participation in the field of cupola melting, our materials showed great promise as high temperature refractories. When tested by several foundries it was found that HY-TEMP REFRACTO BONDING CEMENT was far superior to the ordinary refractories it joined. Similar results were observed when HY-TEMP REFRACTO BRICKS were used with miscellaneous joint materials. Our Bricks withstood temperature stress while the joint materials suffered, in remarkable contrast.

A foundry-operating manufacturer, attracted by this performance, asked us to install a shell lining of HY-TEMP REFRACTO materials in the Melting Zone of one of their cupolas. Their previous linings too frequently burned out to the shell, forcing a cupola shut-down, with consequent loss of production. Month after month went by without "burn-outs" in the cupola with the HY-TEMP REFRACTO SHELL LINING. Thinner linings allowed greater melting zone diameter, with more melting capacity in the existing cupola. A year passed with this shell lining still intact. This was a hitherto unknown record of cupola performance. These, with similar findings, led to the full-fledged manufacture of refractory materials, bricks and other shapes.

Drop us a line on your cupola operating problems . . . or, on any other refractory material problems. HY-TEMP REFRACTO Service Engineers are always available to personally supervise installations and assure complete satisfaction without additional cost to you.

The results in the above Case History No. 133 are a matter of honest accurate record with us and with our customer (whose name will be gladly furnished on request). Today, other firms are finding the same advantages in the use of HY-TEMP REFRACTO materials for cupola shell linings.

When combined with other refractories H.T.R. BRICKS, because of their superior temperature and erosion resistance, permit thinner cupola linings, thereby increasing the melting capacity — in some cases by as much as 2 to 3 tons per hour! HY-TEMP REFRACTO BONDING CEMENT too has proven a strong factor in top cupola operating efficiency. Combined in use these products eliminate "burn-outs"; help prevent bridging; reduce slag accumulation . . . thus, reduce "down-time" losses and maintenance expenses . . . increase labor savings and production.

HY-TEMP REFRACTO MATERIALS PAT. NO. 2567088

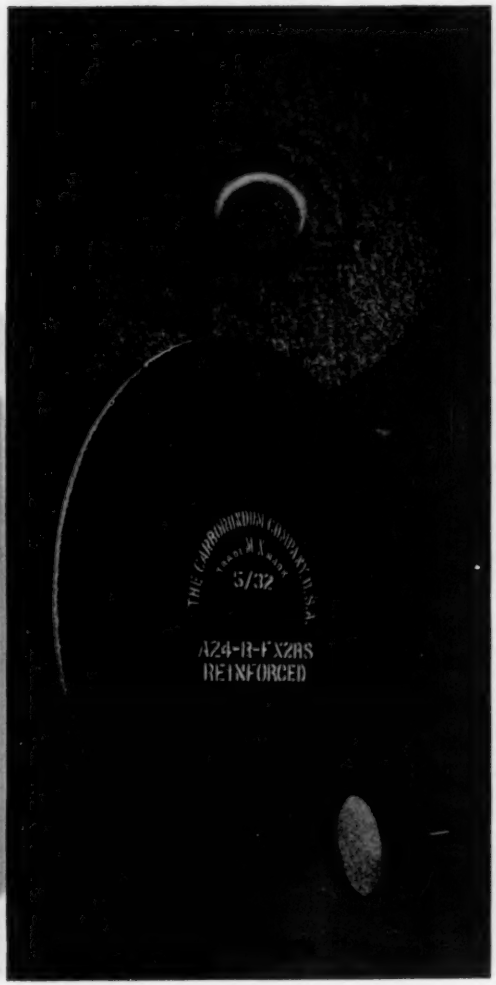
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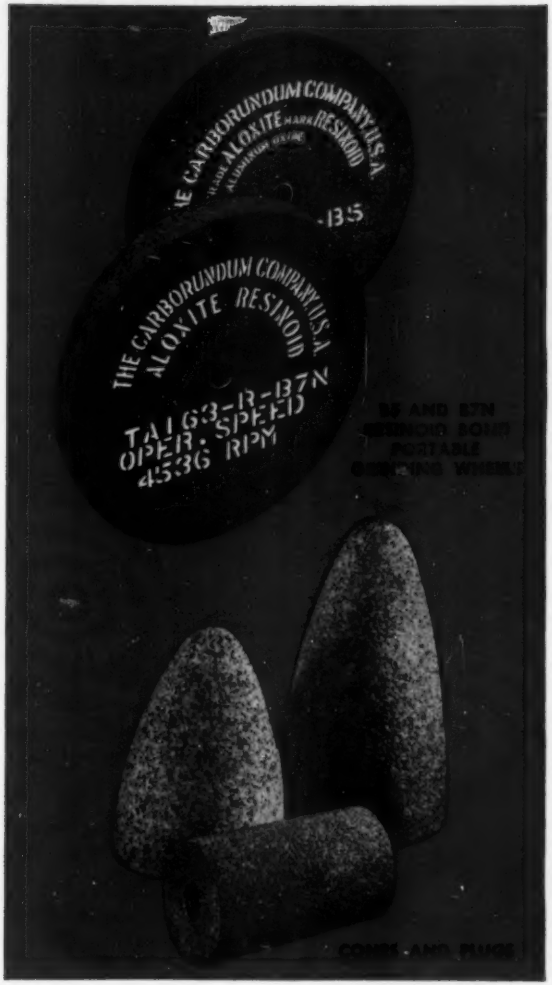


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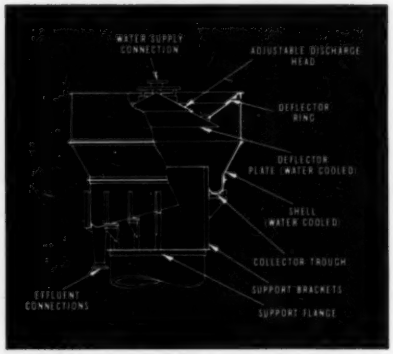
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These 6 sentinels are on guard against nuisance—little more than harmless steam is ever seen.

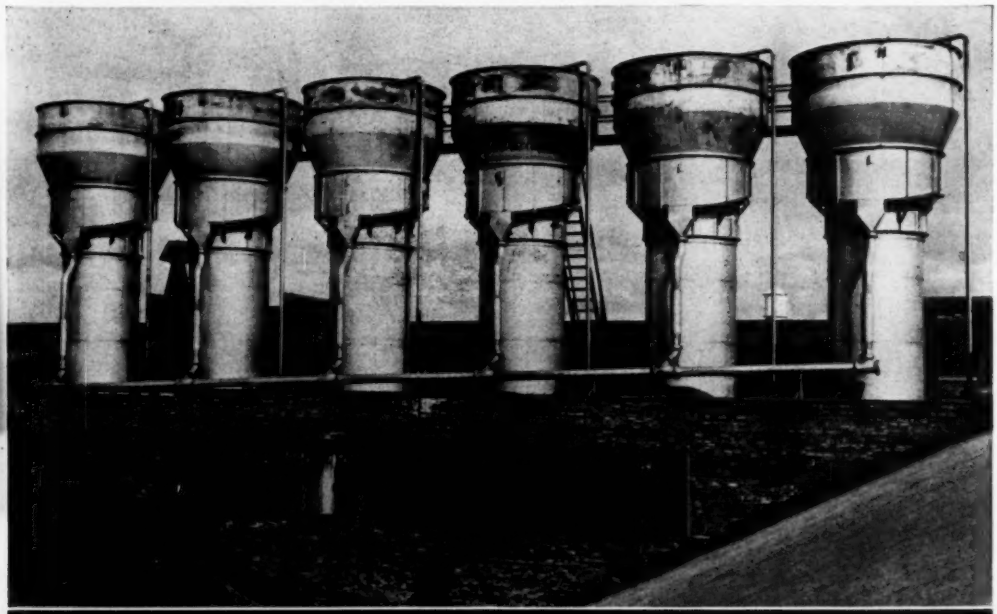
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Little maintenance or attention is required, patented adjustable water discharge heads are non-clogging and no moving parts are used.



Write for Bulletin 449 on Cupola Collectors

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Published by Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How to Control Composition of Cast Iron With Silicon and Manganese Briquets

Control of the composition of cupola-melted cast iron becomes a simple matter through the use of alloy briquets.

These briquets make the old practice of blending two or three pig irons of high and low silicon and manganese contents, to produce a desired composition, both unnecessary and undesirable. A single grade of pig iron can be stocked, and any desired composition in the product can be obtained, simply and economically, by the addition of silicon and manganese briquets.

Function of Silicon in Iron

In cast iron, silicon acts as a deoxidizer and graphitizer. It promotes the formation of flake graphite and softens the iron.

When either the carbon or silicon content of an iron is too low for the section thickness involved, the result will be the formation of chilled spots (iron carbide) at corners and in other rapidly cooled locations. This has an adverse effect on the machinability of the iron and the life of the tools used to machine it. On the other hand, excessively high carbon or silicon content in heavier sections results in open-grained iron that is both soft and weak.

How Silicon Aids Carbon Control

A rather definite relationship exists between the silicon level in a pig iron and its carbon content, as shown in Figure 1.

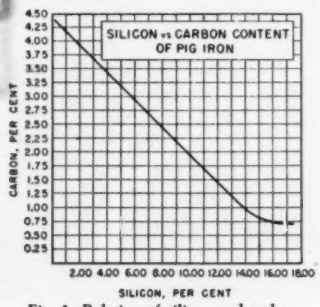


Fig. 1—Relation of silicon and carbon content in pig iron. Notice that the carbon level gradually decreases as the silicon is increased.

As indicated in Figure 1, an increase in the silicon content of a pig iron has a decided effect in lowering its carbon content. When producing soft iron, where it is desirable to hold the carbon on the high side, pig iron running in the range of 2.0 per cent silicon is desirable in the cupola charge, rather than the higher silicon grades of pig sometimes used in these irons. The additional silicon needed to meet the desired chemical analysis can be easily and economically added to the charge in the form of silicon briquets. This provides an economical and flexible system of chemical control.

Function of Manganese in Iron

Manganese acts as a scavenger to deoxidize iron. As an alloying element, it imparts density and high strength. It combines with sulphur to form manganese sulphide, which does not have the harmful characteristics of the iron-sulphide inclusions that form when manganese is not present. A manganese-sulphur ratio of 6:1 is suggested.

Briquets Give High Alloy Recovery

Silicon and manganese briquets are manufactured by ELECTROMET in the sizes shown in Table I. These "EM" briquets are all made with a binder that prevents oxidation until the alloy unites with the iron in the melting zone of the cupola. Thus, the recovery of alloy is high—usually over 90 per cent for silicon and about 85 per cent for manganese.

Booklet Available

Further information is given in our booklet, "Briquetted Alloys For The Iron Foundry Industry." This booklet contains information about "EM" briquets of silicon, silicomanganese, ferromanganese, and chromium. To obtain a copy, free of charge, write or phone our nearest office: in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, or San Francisco. In Canada: Welland, Ontario.

The terms "EM" and "Electromet" are registered trade-marks of Union Carbide and Carbon Corporation.

Table I. "EM" Briquetted Alloys for Cupola Additions

Type of Briquet	*Gross Weight*	*Alloy Content*
"EM" Silicon Briquets (two sizes) Round	5 lb.	2 lb. Silicon
	2½ lb.	1 lb. Silicon
"EM" Silicomanganese Briquets Square	3½ lb.	½ lb. Silicon 2 lb. Manganese
"EM" Ferromanganese Briquets Oblong	3 lb.	2 lb. Manganese

Table II. Typical Briquet Mixture for Soft Gray Iron

Base Charge			*Alloys in Charge Material*			
			Silicon		*Manganese*	
Per Cent	*Lb.*	*Material Charged*	*Per Cent*	*Lb.*	*Per Cent*	*Lb.*
40.0	400	Pig Iron	2.25	9.00	0.75	3.00
40.0	400	Return Scrap	2.50	10.00	0.65	2.60
20.0	200	Purchased Scrap	2.28	4.56	0.55	1.10
100.0%	1,000 lb.	Total Base Charge		23.56		6.70
Briquets Required		4 Small Silicon Briquets		4.00		—
		½ Silicomanganese Briquet		0.25		1.00
		Total Alloys Charged		27.81 lb. Si or 2.78% Si		7.70 lb. Mn or 0.77% Mn
		Melting Recovery Factor		x .90		x .85
		Final Analysis of Iron		2.50% Si		0.65% Mn

easy-to-handle ROTOR CHIPPERS

"PAID OFF" in 45 days

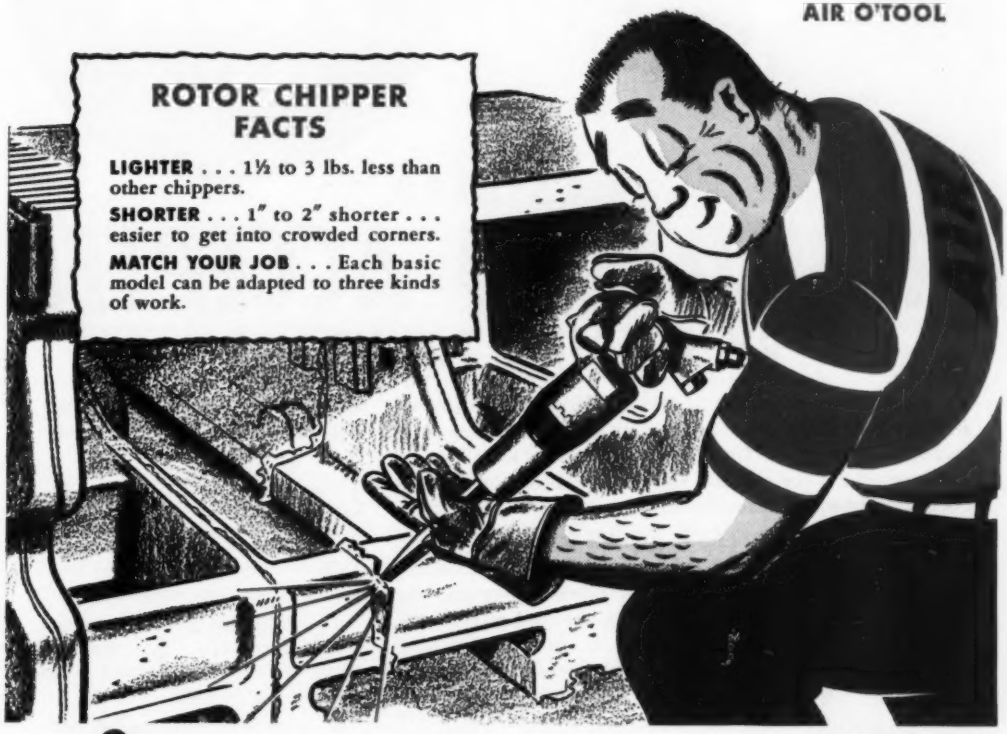
JOB: Removing fins from press frame casting. Former chippers weighed 13½ lbs...were slow-hitting, hard to handle.

SOLUTION: Rotor Application Engineer recommended new Model C-15H Chippers. Weigh only 11½ lbs. Have plenty of high-speed sock.

RESULTS: Stepped up production 65%. "Paid off" new Rotor Chippers in 45 days.

Unusual? Not at all! We will gladly survey your plant for similar benefits. Why not call us in?

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96·B SAND RELEASE AGENT

PREVENTS STICKING ...MAKES SAND FLOW FREELY

Another Foundry "First" by DELTA

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PROVED AND ACCEPTED

BY LEADING FOUNDRIES

By adding only 8 ounces or less of DELTA 96·B SAND RELEASE AGENT, per ton, to your core or molding sand mixes, your sands will flow freely . . . be easier to handle . . . easier to use. They will not stick to core boxes or patterns no matter how intricate they may be.

DELTA 96·B SAND RELEASE AGENT is the result of persistent research by DELTA Laboratories devoted to the discovery and development of a lubricant-dispersant for use in sand mixes. DELTA 96·B is a liquid which provides properties hitherto unknown in sand conditioning materials. It is completely volatile at elevated temperatures and does not contaminate the sand.



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READ WHAT USERS SAY ABOUT DELTA 96·B SAND RELEASE AGENT

". . . . with the addition of 96·B we get improved core density and more uniformly-rammed mold hardness."

". . . . with the addition of 8 ozs. of Delta 96·B we are now able to blow cores we otherwise couldn't blow."

". . . . Delta 96·B gives the sand improved flowability. Our sand now works much more freely and leaves the core boxes clean."

". . . . and the trouble we had with sand sticking in the hoppers, in the chutes and on the conveyor has been eliminated with the use of Delta 96·B."

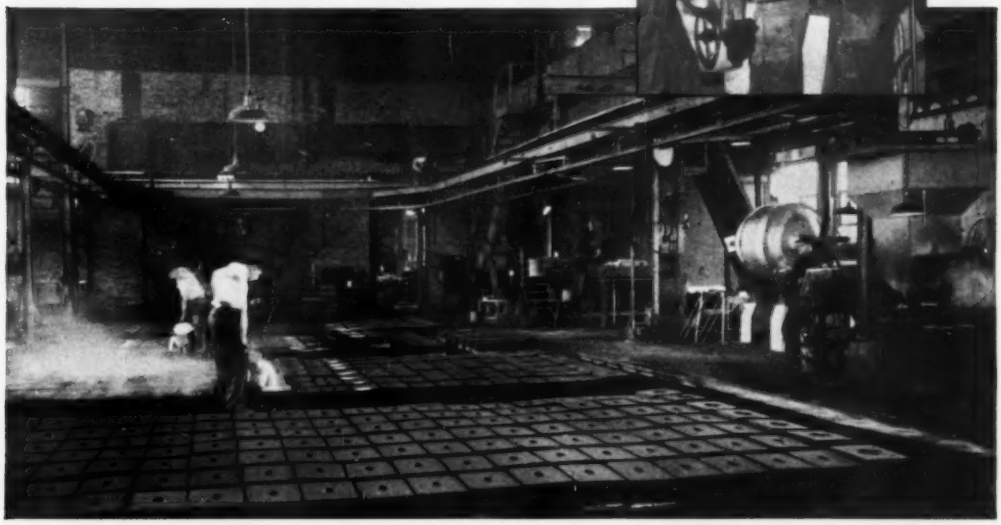
DELTA OIL PRODUCTS CO.

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Borings Wanted... as is

Detroit Rocking Electric Furnace, purchased to remelt borings from concern's own machine shop, proved so fast and efficient that the company buys borings outside to keep furnace working. Borings used as is, not briquetted.

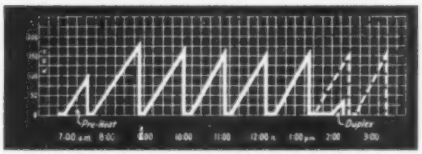




Machine shop to melting furnace to molds . . . an efficient operation using DETROIT ROCKING ELECTRIC FURNACE

Here's another example of improved foundry operation with Detroit Rocking Electric Furnaces.

At Standard Automotive Parts Company, the Detroit, started the same time as the cupola, cold melts until the cupola is ready to tap. They usually have six cold heats, then cold cupola iron is put into the Detroit Electric Furnace, heated, and poured into molds. Furnace used, with excellent efficiency, about 80% unbriquetted borings.



Operating graph, Type LFY, 175KW, 700 lb. Detroit Electric Furnace, melting gray iron. Charge, 600 lbs. Total metal, 4200 lbs; total KWH, 1296; av. power consumption, inc. preheat, 617 K'WH/ton; total hours operation, 8½; av. melt time, 39 mins.

For ferrous and non-ferrous metal melting, Detroit Furnaces are fast, make optimum use of power, produce metal of uniformly high quality, achieve lowest metal loss by shrinkage.

Send your production data. Our engineers will furnish facts on how Detroit Electric Furnaces will fit into your operations.

DETROIT ELECTRIC FURNACE DIVISION

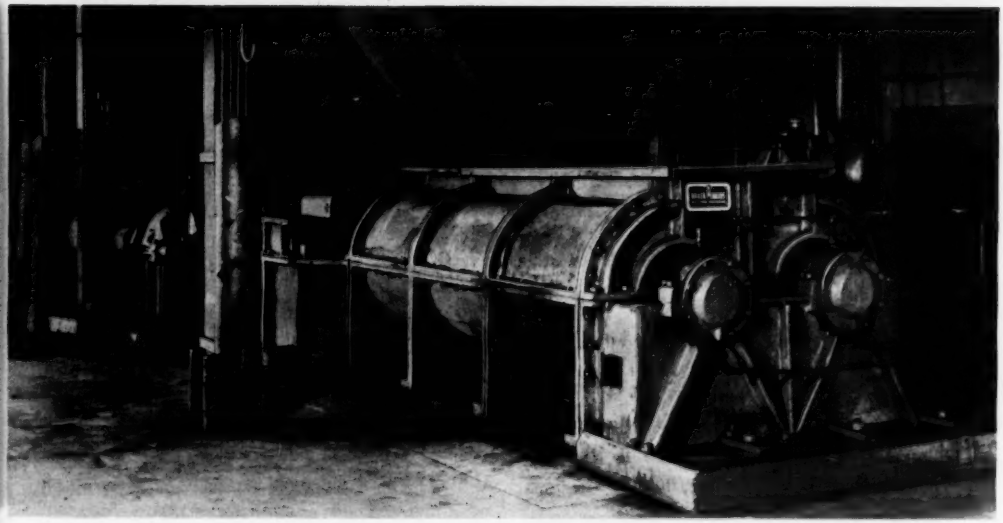
KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Elsa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.

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processed by Baker Perkins mullers in world's biggest grey iron foundry



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BAKER PERKINS INC.
SAGINAW, MICHIGAN

189



What's the lining life of your
high frequency induction furnaces
melting nickel-chrome steel alloys?

Get more heats with rammed linings of

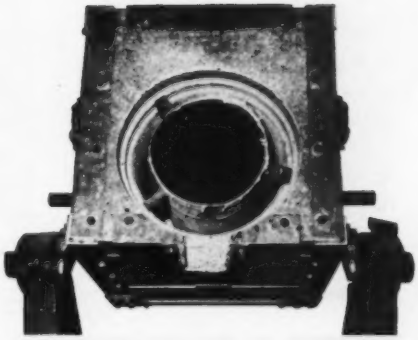
Taylor Zircon

Many foundries have standardized on Taylor Zircon No. 717 grog-type Ramming Mix for lining Ajax-Northrup, Allis-Chalmers and other types of high-frequency furnaces melting nickel, stainless steel and similar high nickel-chrome alloys. High softening point, low thermal conductivity, high di-electric strength, freedom from shrinkage make Taylor Zircon an excellent refractory for this service.

FACTS . . .

- Average life of linings made of Taylor Zircon No. 717* Ramming Mix is 20 to 30% longer than that of linings rammed of magnesia, magnesia-alumina spinel and/or sillimanite or mullite when melting high nickel alloys.
- A foundry operating four 650 lb. Allis-Chalmers high frequency furnaces obtained 117 heats on a No. 717 rammed lining melting pure nickel and nickel-bronze alloys.
- A foundry melting 97.5% nickel in 650 lb. Ajax-Northrup obtained 80 heats on Taylor Zircon before patching was required.

A complete line of TASIL (converted mullite), TAMUL (synthetic mullite) and TAYCOR (corundum base) Ramming Mixes and Patches are also offered for varying service conditions. Detailed information contained in Bulletin 315—just off the press. Write for your copy.



Installing Taylor Zircon No. 717 (Wet) Ramming Mix in 300 lb. Ajax-Northrup induction furnace. Before ramming the lining, Taylor Sillimanite (TASIL) No. 101 Patch is used for sealing the primary coil. After drying, Taylor Zircon is rammed in place and No. 101 Patch is used to seal the top and for forming the pouring spout.

Photo at top of page shows the interior of a 1000 lb. Allis-Chalmers furnace lined with Taylor Zircon at end of pour.

** Shipped either WET or DRY—specify on your order.*

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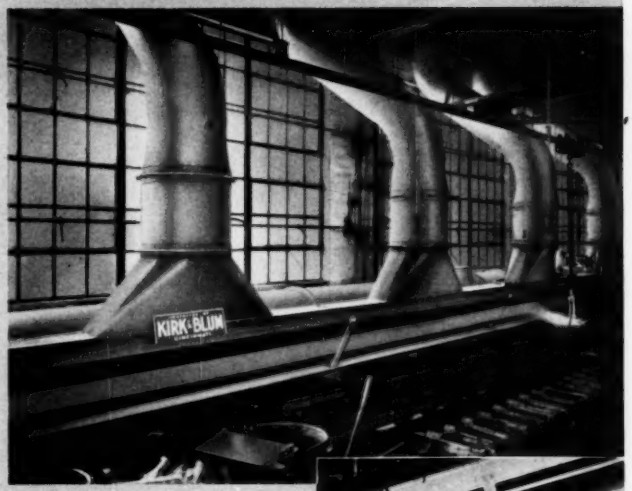
AT THE WM. POWELL COMPANY—VALVE MANUFACTURERS

1—SHAKE-OUT AND SAND HANDLING
2—CUT-OFF SAW
3—GRINDING AND SNAGGING
4—FURNACE EXHAUST
5—MOLD POURING STATION
6—TRANSFORMER ROOM VENTILATION

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Whether your foundry melts a few tons per day or thousands of tons, its efficiency can be increased through intelligent use of the "invisible tool"—clean air.

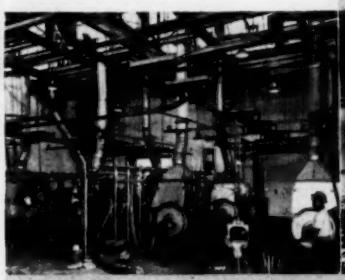
Let Kirk & Blum Engineers survey your operations. For further details, request literature. The Kirk & Blum Manufacturing Co., 3176 Forrer Street, Cincinnati 9, Ohio.



Filled ladles, brought to this section of the pouring station by overhead conveyor, are poured by operators standing on a "floor" moving with the flask conveyor. The continuous slotted Kirk & Blum hood collects fumes over the entire length of the pouring station.



A dual system controls dust from sand handling operation as well as dust generated in shake-out (illustrated). Kirk & Blum "Cross Draft Lateral Exhaust" gives unobstructed working area.



Section of electric furnace room; individual exhaust hoods over tilting furnaces effectively remove hot gases and fumes.



Battery of double grinders; note placement of exhaust headers in unused ceiling space. All exhaust equipment is located outside building, conserving floor space.

for clean air . . . the INVISIBLE tool

KIRK AND BLUM
DUST CONTROL SYSTEMS

Get that extra production

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HOW TO USE

FEDERATED PHOSPHOR COPPER

IN THE FOUNDRY

Use proper "oxidizing" melting practice. Always have a clear green flame over the furnace. Burn all the fuel and have some additional oxygen available in the products of combustion. Don't use any fluxes or covers.

After the crucible has been placed on the floor and skimmed clean twice, add two ounces of 15% phos copper per 100 pounds of melt just before pouring . . . stir in lightly and pour.

Federated phos copper, when used in this way for tin bronzes, leaded tin bronzes, and high lead alloys, reduces the possibility of porosity . . . increases fluidity or "castability" of the melt . . . gives sharper detail.

An illustrated wall chart on "How To Use Phos Copper" gives full details on proper foundry practice. The wall chart is available free on request. For your copy, write Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y.



Federated Metals Division

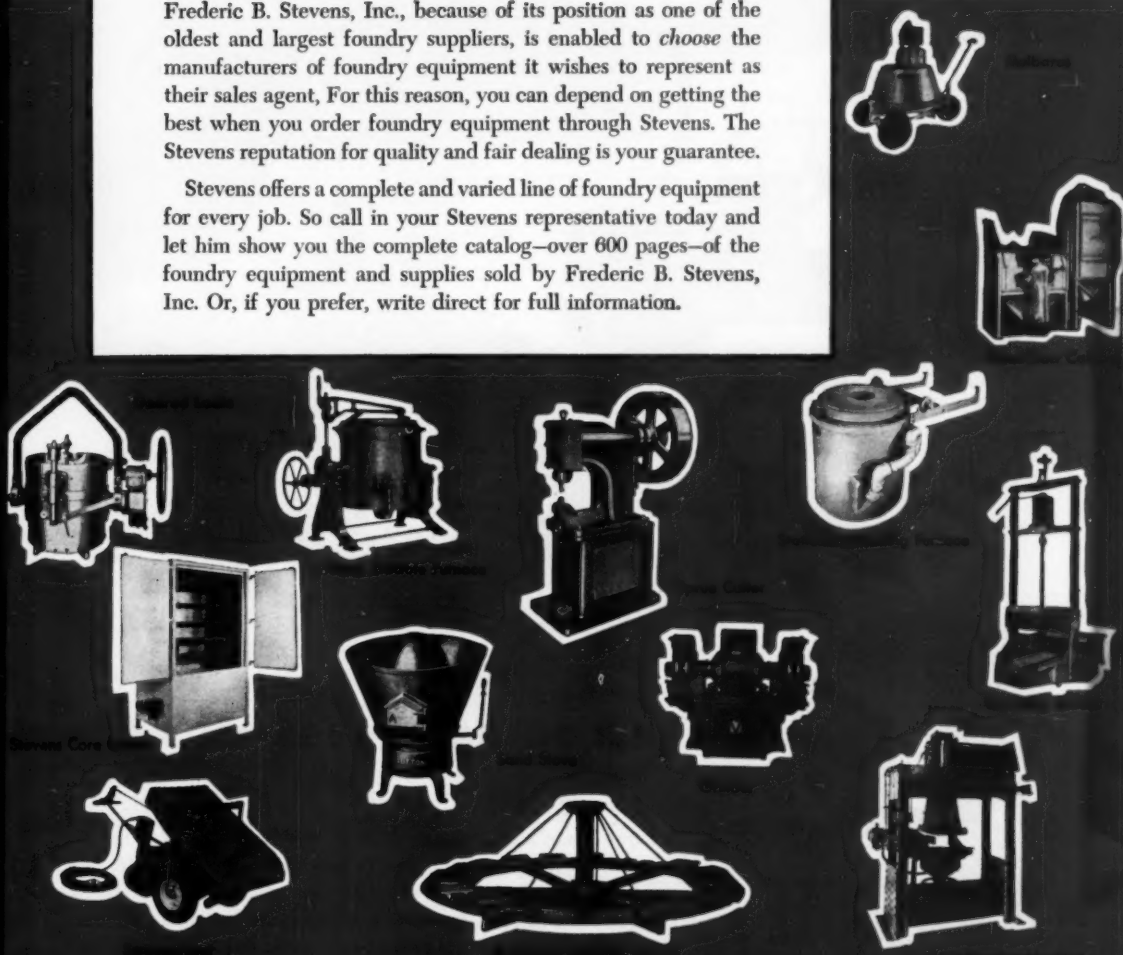
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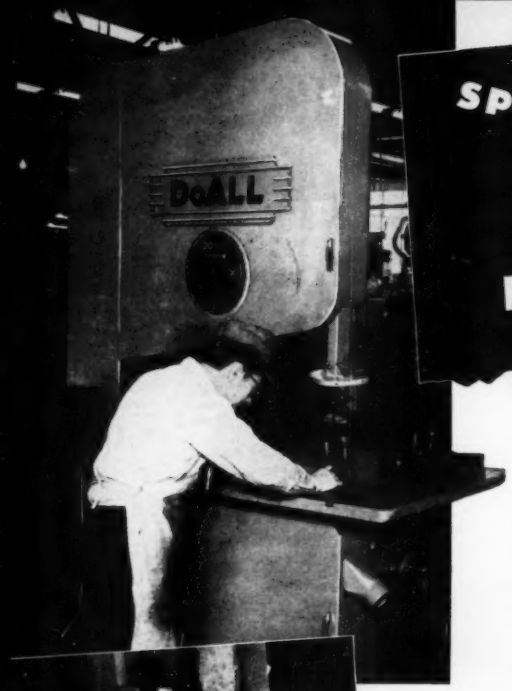
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Sure. There's a gun and a jeep and a tank and a cotton farmer. What you don't see is how Tennessee fits into the picture. You can't see that by looking at these finished products. Because Tennessee supplies basic chemicals and metallurgical products essential to defense production. They aren't visible in the end product, but they're there . . . . and the people at Tennessee are proud of it.

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THE speed of DoALL Zephyr Band Machines for removing gates, risers, flash and other superfluous material from castings will surprise you. DoALL Zephyr Band Machines are fast: they have actually saved as much as 90% in time and tool costs, depending on the thickness of the work. With DoALL you are able to get into complicated spaces and cut *close* to the casting and as finish is generally of high quality, grinding can be either eliminated or materially reduced. The cut is made fast enough so as not to allow heat penetration into the side wall of the finished cut and skin hardness never exceeds .003" deep. Zephyr Friction Sawing means low tool cost and greater tool safety for the operator.

Where extremely fine tolerance and optimum efficiency is desired, automatic hydraulic feeding tables are available. There is a size DoALL Zephyr for every pocketbook and for almost every problem. If you have a special problem we will cooperate with you in tailoring saw design to solve it. Here are advantages you should look into. Ask for a free demonstration in your own plant. Call our local DoALL Sales Service Store or write.

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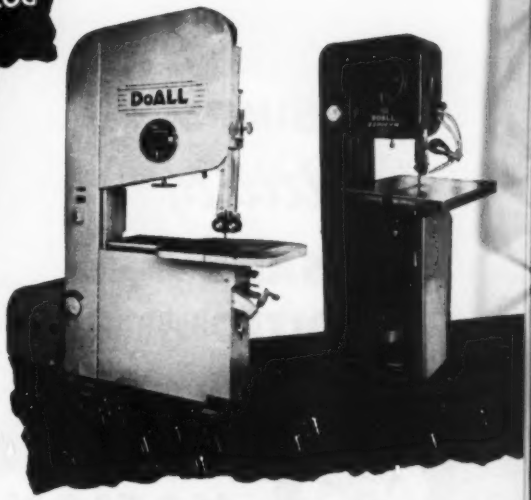
Above: **Here is a DoALL Zephyr in a typical installation removing dead metal.**

Below: **With DoALL Friction Sawing you can cut close to the live metal and reach the hard-to-get-at places.**

SEND FOR CATALOG



There is quite a story on costs and speeds in handling castings of various thicknesses. Ask for complete details with a catalog on DoALL Modern Band Machines.



BMF-1

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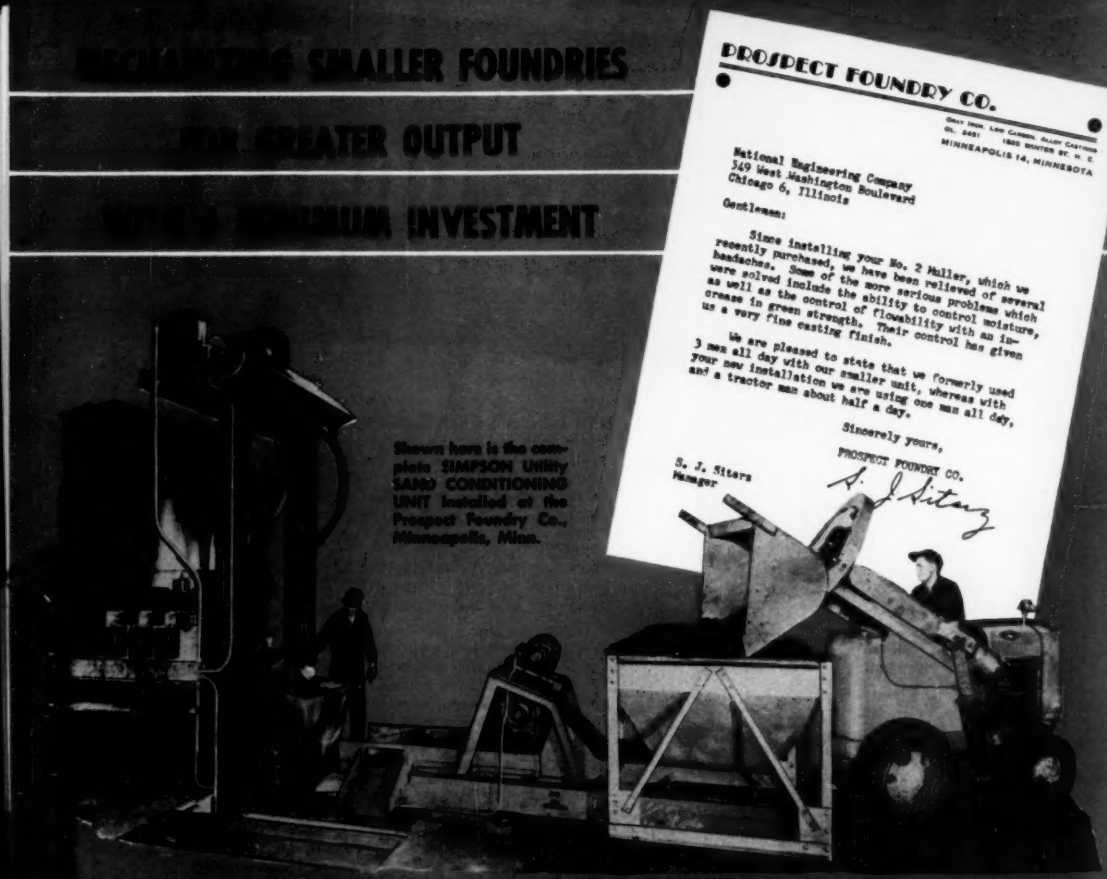


Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies

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FOR GREATER OUTPUT

WITH A MINIMUM INVESTMENT



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Since installing your No. 2 Muller, which we recently purchased, we have been relieved of several headaches. Some of the more serious problems which were solved include the ability to control moisture, as well as the control of flowability with an increase in green strength. Their control has given us a very fine casting finish.

We are pleased to state that we formerly used 3 men all day with our smaller unit, whereas with your new installation we are using one man all day, and a tractor man about half a day.

Sincerely yours,

PROSPECT FOUNDRY CO.

S. J. Sitarz
Manager

Shown here is the complete SIMPSON Utility SAND CONDITIONING UNIT installed at the Prospect Foundry Co., Minneapolis, Minn.

The SIMPSON *Utility* SAND CONDITIONING UNIT

IT'S IMPORTANT FOR SMALLER FOUNDRIES TO READ THE ABOVE LETTER FROM S. J. SITARZ, MANAGER OF PROSPECT FOUNDRY COMPANY! . . . It's important because it tells you how Prospect Foundry relieved several sand conditioning and casting "headaches" with a SIMPSON Utility SAND CONDITIONING UNIT . . . and how man-hours of work were cut in half by this efficient method of mechanization.

A SIMPSON Utility UNIT affords smaller foundries the advantages of large-scale mechanized operations by boosting production and reducing variable costs. With a minimum initial investment, smaller foundries receive 1) efficient, mechanized handling of sand to and from molding stations; 2) properly conditioned sand; 3) castings of high uniform quality; 4) better utilization of floor space; 5) better working conditions.

Complete SIMPSON Utility SAND CONDITIONING UNITS consist of a standard SIMPSON Intensive Mix-Muller and Bucket Loader assembly—a complete screening and magnetic separator unit—and a simple, positive discharge sand hopper . . . fed by a versatile "PAYLOADER."

For further details, write for BULLETIN 507.

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AN OUNCE OF PREVENTION

IN THE TREMENDOUS defense rearmament program on which the country has embarked, the foundry industry is called on to play its usual prominent part. Castings of a wide variety of kinds and specifications will be required in increasing numbers from all branches of our industry. Government Agencies and plans such as the National Production Authority and the Controlled Materials Plan have been set up to control the flow of materials and equipment to defense projects.

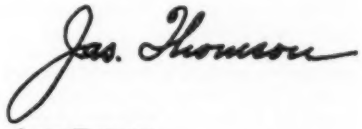
These regulations are making it increasingly difficult for foundries to secure new equipment and replacements, and even when permission to purchase is granted, delivery may be too far in advance for immediate needs.

Demands of the times will call for increased production by many foundries. This may mean increased hours of operation or speeding up of existing equipment if additional equipment cannot be obtained in time for the job at hand. Under these circumstances, increased effort should be made to keep present equipment operating as efficiently as possible.

Each foundry must review its maintenance policies critically—is the maintenance department well-organized and efficient, keeping down-time of equipment to a minimum by proper preventive measures—or is it merely a repair department for fixing up things when breakdowns occur? In too many cases, maintenance is still looked upon as a necessary evil. It is a necessary business function and an important part of any manufacturing operation, and whether it is conducted in an efficient or in a slipshod manner will be reflected in company profits. Management must realize this and be responsible for maintenance policy.

As both large and small foundries become more and more mechanized and electrified, the need for better maintenance increases. Considerable literature on the subject has developed in recent years; much of it appears in A.F.S. TRANSACTIONS. Information is also available in papers presented at maintenance congresses sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management.

While it is not possible to go into detail about individual maintenance programs here, these basic principles of good preventive maintenance apply to any foundry—sufficient personnel, proper equipment and tools, adequate inspection of equipment to prevent breakdowns, good records, planned down-time, and adequate spare parts.



JAMES THOMSON
Chief Engineer
CONTINENTAL FOUNDRY & MACHINE CO.

A.F.S. National Director James Thomson has long been a recognized authority on maintenance of foundry equipment, having spoken frequently on the subject before chapter, regional and national meetings of A.F.S. and other metals technical societies, and is chairman of the A.F.S. Plant & Plant Equipment Committee. Born in Glasgow, Scotland, Mr. Thomson moved to Pittsburgh when he was eight years old, attending grade and high school there, and Washington and Jefferson University. After serving as a draftsman for several foundries, he became plant engineer for United Engineering & Foundry Co., leaving there to become chief engineer for Hubbard Steel Co. When that organization was incorporated into what is now known as Continental Foundry & Machine Co., Mr. Thomson was made chief engineer for the entire organization, a position he has held since 1916. He is past chairman of Chicago Chapter.

K.O. risers are O.K.

Application of necked-down risers on steel castings for oil-field service greatly reduced chipping and burning time, as the risers are readily broken off on the shakeout, and the area requiring scarfing and grinding to casting contour was reduced by 93 per cent. Direct labor savings on cores, molding and closing, shakeout and cleaning totaled 17.8 per cent.

L. C. Hollien, Pattern Supv.
Texas Electric Steel Castings Co.
Houston, Texas

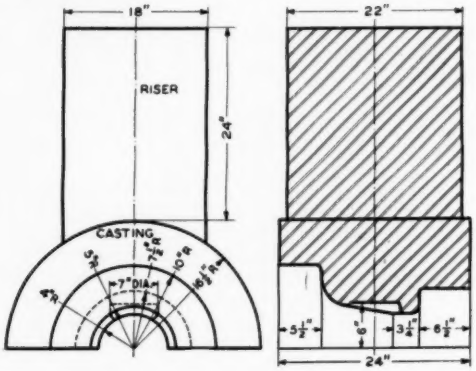


Fig. 1—Heavy metal sections throughout this casting, sketched with conventional open riser, make it particularly adaptable for necked-down riser application.

NECKED-DOWN OR KNOCK-OFF risers, K.O. for short, are applied to types of castings requiring maximum efficiency of the riser in order to secure soundness. The design of these castings (Fig. 1) is a very practical one for a K.O. riser application due to the heavy metal sections throughout the casting. However, this does not mean that the successful application of K.O. risers is limited to castings of heavy metal sections or to any particular design.

On the contrary, it is usually economical and good practice to apply K.O. risers to any casting ordinarily made with an open riser, providing it is practical to construct a core box with the proper neck opening, core thickness, and adequate space for applying the K.O. riser to the contour of the casting in proper relation to the core and the metal sections in the casting. The surface area and depth of the casting are vital factors requiring study and consideration.

The oil field equipment industry uses a large tonnage of steel castings. This article will show an application of the K.O. riser to castings of this type weighing over 2000 lb. The K.O. risers for these castings range in size from 20 in. to 28 in. in diameter. The actual shipping weights range from 2368 to 4194 lb.

The steel poured into these castings is analysis number NE-8735. Figure 1 shows this type of casting as formerly made with the conventional open riser, which was rectangular in shape, 18x22x24 in. high on this particular size of casting. The removal of the riser represents a costly and time consuming operation when done with a cutting torch because it must be performed after annealing and while the casting is still hot. It is also necessary to make three cuts through the riser area.

The casting and riser were annealed at 1650F for an 8 to 10-hr period, and the riser was cut off before the casting had cooled below 600F. This was done in order to prevent the casting from cracking in the riser area. The time required to reach temperature and cool from 1650F to 900F before actual cutting could start was about 24 hr. Additional cost was incurred in scarfing the riser down to the 16½-in. radius contour of the casting before it was ready for the grinding operation, which covered an area of at least 400 sq in.

Use of the K.O. riser on this casting (Fig. 2) reduced the scarfing and grinding area to about 28 sq. in., a reduction of 93 per cent. In addition, annealing was not required before cutting and cutting time was eliminated because the K.O. riser was knocked off the casting on the shakeout. It was found that the risers would break from the castings most readily if the castings were vibrated on the shakeout machine in an upright position, that is, with the flat side of the casting down and the riser up. The chemical analysis of the casting shown in Fig. 2 is as follows:

	Per Cent		Per Cent
Carbon	0.31	Sulphur	0.047
Manganese	0.75	Chromium	0.62
Silicon	0.50	Nickel	0.67
Phosphorus	0.040	Molybdenum	0.23

Heat treatment consists of annealing, water quenching, and drawing to secure a Brinell hardness of 290 to 320 for durability in service. Physical properties from heat treatment resulted in a yield point of 126,000 psi, tensile strength of 141,500 psi, reduction of area 48.6

Fig. 2—Casting (cleaned weight, 2368 lb) and necked-down riser which was knocked off during shakeout, leaving about 28 sq. in. grinding area (93% reduction).





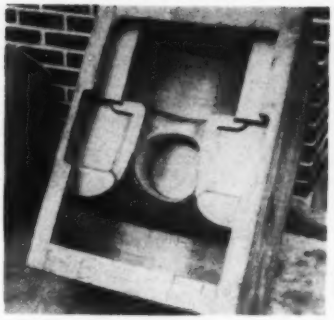


Fig. 3—Left, pattern for the casting and core print (B) for the 20-in. diameter knock-off riser. Right, core box for the main body core of the casting.

per cent, elongation 18 per cent, and 293 Brinell hardness. These properties provided the required toughness in these castings as considerable difficulty had been encountered with cracks and actual breakage in service before adoption of the above specifications and the use of K.O. risers.

The pattern and core box for this casting are shown in Fig. 3. In determining the proper core for applying the K.O. riser to these castings, research data available were carefully studied and combined with the experience already gained in applying K.O. risers to other smaller size miscellaneous steel castings. In this way the design and the dimensions for the knock-off core (Fig. 4) were worked out.

The core box is made to the 16½-in. radius contour of the casting. The core is 1⅝ in. thick, 22 in. long and 22 in. wide in order to accommodate the 20 in. diameter riser required to feed the casting. The neck is 4 in. in diameter, and is in the center of the core 13/16 in. above the casting. No attempt was made to make the opening closer to the casting because of the possibility of the riser breaking off in an irregular fracture which might run into the outer surface of the casting. The cores are rodded with eight ⅜-in. rods.

Pattern equipment for the K.O. riser is shown in Fig. 5. The knock-off cores for making the largest size of these castings are 1⅞ in. thick, 34 in. long, and 30 in. wide, and are made on a 16½-in. radius to fit the outside contour of the castings. The neck opening is 5½ in. in diameter and is 15/16 in. above the casting surface so an irregular break when removing the riser does not run into the casting. A 28 in. diameter riser 28 in. high is used to feed the casting. Ten vents are used on each end of the cores and 12 rods ½-in. in diameter are used. These large cores are made and baked in the same way as the 20 in. K.O. riser cores.

Figure 6 shows a knock-off core for a 20 in. diameter riser and a main core ready to be placed in the mold before pouring. The eight vents for the escape of gas from the knock-off core are visible at one end of the core. Eight more vents lead off in the opposite direction on the other end.

The cores are made from a South Texas river sand of approximately 46 A.F.S. fineness with a sintering point of around 3035F. The sand is of a sub-angular grain structure. The core sand mixture is as follows:

New Sand, lb.	350	Bentonite, qt.	2
Silica Flour, lb.	300	Core Oil, qt.	8
Cereal Binder, qt.	8	Iron Oxide, qt.	4

This mixture gave approximately the following physical properties: green strength, 9 to 11 psi; permeability, 0.0 to 5.0; moisture, 7.0 to 8.0 per cent; density, 125 lb/cu ft; dry strength, 240 to 250 psi.

Extreme care was taken to obtain very thorough mixing. This can best be accomplished by doubling the usual mulling time required for other core sand mixtures. The main cores shown in Fig. 6 are faced very thinly with the same core sand. These cores are baked in a tower type continuous oven. The knock-off cores are made with a bedding frame and are baked on a green sand bed at 450F for 3 hr.

This is the regular cycle of the continuous core oven.

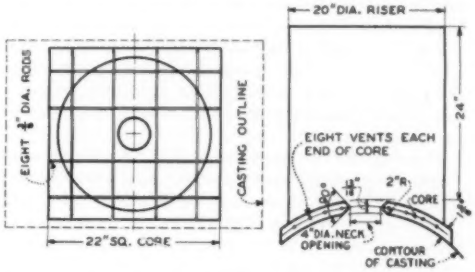


Fig. 4—Knock-off core design and dimension details (2368-lb casting) were worked out from research data and experience in applications to smaller steel castings.

Fig. 5—Core box (A) and core print (B) for the 20 in. diameter knock-off riser. The neck opening (C) is 4 in. in diameter. Construction details are shown in Fig. 4.

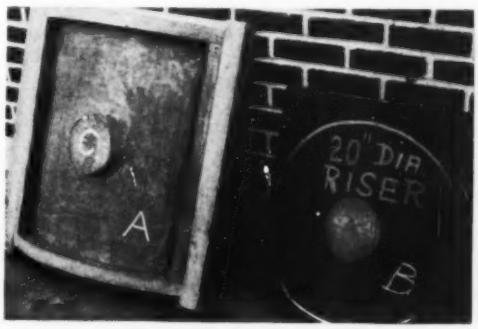




Fig. 6—Left, knock-off core for 20 in. diameter riser has eight vents in each end for escape of core gases. Right, main body is ready for placing in the mold.

The knock-off cores are then removed from the bedding sand and are turned over and are baked another 3 hr at 450F. In other words, they go through the oven twice to insure thorough baking. After baking the cores are swabbed on both sides with a prepared commercial core wash.

The knock-off core is securely tied into the cope of the mold by means of four wires running through the holes at the four corners of the core print (Fig. 7). These holes also serve as vents for the gas to escape from the eight vents in the knock-off core. The seams around the core are carefully stopped up and washed with core wash. All moisture is dried out with a mold drying torch before closing the mold.

Check Pouring Temperature

The steel for these castings is melted in a 3-ton electric furnace and tapped into a bottom-pour ladle. The molds are provided with 2-in. core down gates. The metal is poured as cold as possible, usually at about 2780F. An optical pyrometer is used for checking the temperature while pouring. The metal is poured into the mold as rapidly as possible, using a 1½-in. nozzle in the ladle.

Pouring through the gate is stopped as soon as the metal in the mold has completely covered the knock-off core to a depth of about 2 in. The riser is then filled slowly by pouring directly into it. The tops of the risers are covered with a commercial pipe eliminator to a depth of at least 1½ in. The yield realized on these castings is just about 50 per cent. No doubt, this can be increased by using an exothermic pipe eliminator which is especially effective on large risers.

The riser shown in Fig. 2 weighs 2375 lb. The actual shipping weight of the casting after cleaning and heat treatment is 2368 lb. The same proportion is maintained on the larger castings of this type. On the largest of these, the 28 in. diameter riser weighed 4206 lb, and the shipping weight of the casting was 4194 lb.

The foregoing description shows what has been accomplished and adopted as standard practice for producing this particular type of casting. The following table shows the comparative direct labor savings which were obtained, which amount to an over-all saving of 17.8 per cent.

Operation	Time, min. Open Riser	K.O. Riser
Shakeout	18.00	18.00
Chip and Burn	70.25	1.78
Shot Blast	15.50	15.50
Scarf	26.00	20.20
Swing Grind	35.70	—
Finish Grind	64.00	64.00
Cores, Molding and Closing up	274.00	294.00
Total	503.45	413.48
Direct Labor Saving—17.8%		

As a result of these riser experiences, considerable progress has been made toward applying K.O. risers to other types of castings. The research data available together with foundry experience and individual ingenuity make a good combination for working out successful applications.

Conclusion

Good foundry practice and close control of all production elements together with quality workmanship are necessary for continuous uniform results. This includes controlled and uniform sand mixtures, good cores properly made and thoroughly baked, carefully rammed and well finished molds together with careful and clean mold closing. Also, laboratory controlled and uniformly good metal is vitally essential.

Close observation of pouring rates and temperatures are required for successful results. It all adds up to better control and better workmanship throughout, paying off in better castings. These procedures when followed in the steel foundry ordinarily result in production of uniformly good castings, and are definitely proving that K.O. risers are O.K.

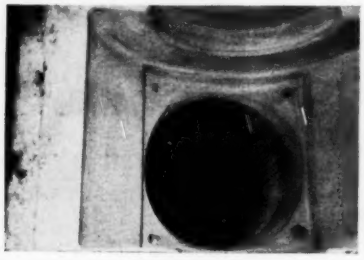


Fig. 7 (left)—Mold cope shows print for knock-off core with holes in each corner for tying the core, and which also act as core vents.

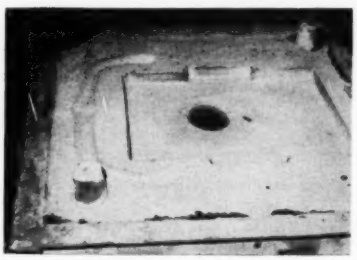
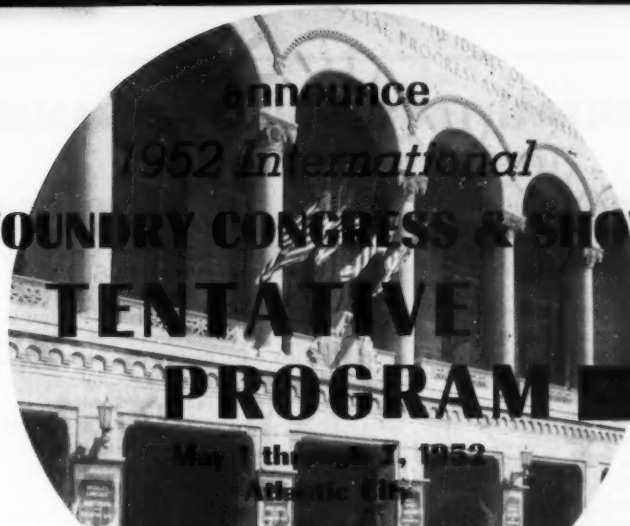


Fig. 8 (right)—Drag half of mold has the two in-gates and the print for the main body core shown in Fig. 6.



announce
1952 International
FOUNDRY CONGRESS & SHOW
TENTATIVE
PROGRAM

May 1 thr[illegible] 7, 1952
Atlantic City

AFS

GREATEST AND MOST DIVERSIFIED [illegible] in A.F.S. history is scheduled for [illegible] through May 7, 1952, when the American Foundrymen's Society will be host to the world's foundrymen in an unprecedented seven-day-long International Foundry Congress & Show at Atlantic City, N. J.

Foundrymen of the free world will converge on Atlantic City's huge Convention Hall, largest in the world, to hear foremost technologists and foundry operating men discuss the industry's newest developments, to exchange knowledge with their fellow foundrymen, and to view the latest and best tools of the foundry trade at the concurrent Exhibit.

Technical sessions and related events will be closely scheduled by Divisional interest. For example, non-ferrous sessions, shop courses, committee meetings and round table luncheons are all scheduled for the first three days, with ferrous sessions and activities largely confined to the last three days of the Convention. Such general interest sessions as Costs, Time Study and Methods, etc, are also primarily scheduled for the last three days.

Technical sessions and related events will be held at the Convention Hall, while luncheon meetings, dinners and social events will be held in the official Convention hotels. This year, however, because of an anticipated extra-large attendance, the Annual Banquet will be held at the Convention Hall.

Opening day, Thursday, May 1, is designated "Defense Day." Registration begins at 8:30 a.m. and exhibits open at 9:30. Only other morning event is the Official Opening Ceremony at the Convention Hall. Following this is the Non-Ferrous Defense Production Luncheon, and, later in the afternoon, non-ferrous technical sessions.

Friday, "Chapter Day", will feature plant visitations and Brass & Bronze, Aluminum & Magnesium, Patternmaking and Sand sessions in the morning, followed by the Aluminum & Magnesium and Pattern Round Table Luncheons. Afternoon's program consists of a Malleable session, a Brass & Bronge session, a Sand Shop Course (Non-Ferrous) and Non-Ferrous [illegible] Officers and Directors Dinner [illegible] the day's program.

Exhibits will remain closed until noon on Saturday, May 3, to allow foundrymen to attend the Annual A.F.S. Business Meeting at 10:00 a.m., and the top technical convention address, the Charles Edgar Hoyt Annual Lecture, at 11:00 a.m. Aluminum & Magnesium, Brass & Bronze, Patternmaking, Malleable, Educational, Safety & Hygiene & Air Pollution (Non-Ferrous) sessions will take place that afternoon. In the evening will be the Annual Banquet.

Sunday, May 4, "International Day," exhibits will be open free to Chesapeake, Metropolitan and Philadelphia chapter area foundrymen. No technical sessions are scheduled but several international and A.F.S. committees will meet. Day's highlights are the International Reception for overseas foundrymen at 4:30 p.m., and the United Kingdom Dinner.

Monday, May 5, is designated "Management Day" and will be devoted to Gray Iron, Steel, Malleable, Sand, Safety & Hygiene, and Time Study & Methods sessions in the morning. At noon are the Malleable Round Table Luncheon and the Ferrous Defense Production Luncheon Meeting. Afternoon technical sessions include Safety & Hygiene & Air Pollution (Ferrous), Education, Gray Iron Shop Course, Sand Shop Course (Ferrous), both Ferrous and Non-Ferrous Plant & Plant Equipment, and Cost sessions.

Tuesday, May 6, "Old Timers Day," will feature an Old Timers Molding Contest and Gray Iron, Heat Transfer, Costs and Education sessions in the morning: and the Gray Iron Round Table and Equipment and Supplies Luncheon meetings at noon. Steel, Gray Iron, Time Study & Methods and Refractories sessions are scheduled for the afternoon. In the evening is the International Educational Dinner.

Final day, May 7, is designated "Exhibitors Day" and will open with morning Gray Iron, Steel and Sand sessions. Last technical event will be the Steel Round Table Luncheon. The exhibits will remain open until 4:00 p.m., when the 1952 International Foundry Congress & Show will officially close.

SEE FOLLOWING PAGES FOR TENTATIVE PROGRAM

TENTATIVE SCHEDULE OF SESSIONS FOR

MAY 1 THROUGH 7, ATLANTIC CITY, N. J.

THURSDAY, MAY 1
"Defense Day"

8:30 am Registration Begins
9:30 am Ladies Registration Begins
Exhibits Open
11:45 am *Official Opening Ceremony*
12:30 pm Brass & Bronze Round Table Luncheon
Defense Production Luncheon—
Non-Ferrous
2:00 pm Technical Session
Aluminum & Magnesium
4:00 pm Technical Sessions
Aluminum & Magnesium
Sand Shop Course—Non-Ferrous
Non-Ferrous Shop Course
5:30 pm Exhibits Close

FRIDAY, MAY 2
"Chapter Day"

9:00 am Registration Opens
Exhibits Open
9:30 am Plant Visitation Groups Depart by Chartered Buses
10:00 am Technical Sessions
Aluminum & Magnesium
Brass & Bronze
Patternmaking
Sand
12 noon Round Table Luncheon Meetings
Aluminum & Magnesium
Patternmaking
2:00 pm Technical Sessions
Brass & Bronze
Malleable
3:00 pm Official A.F.S. Ladies Tea
4:00 pm Technical Sessions
Sand Shop Course—Non-Ferrous
Non-Ferrous Shop Course
7:00 pm *Chapter Officers & Directors Dinner*
9:30 pm Exhibits Close

SATURDAY, MAY 3
"President's Day"

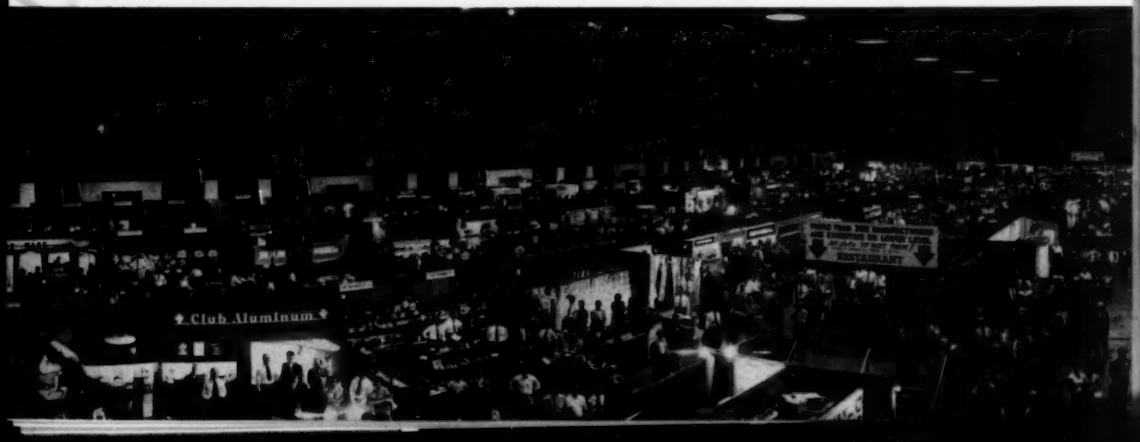
9:00 am Registration Opens
10:00 am *Annual A.F.S. Business Meeting*
Election of Officers and Directors
Apprentice Contest Awards
Welcome to International Delegates
11:00 am *Charles Edgar Hoyt Annual Lecture*
12 noon Exhibits Open
2:00 pm Technical Sessions
Aluminum & Magnesium
Brass & Bronze
In-Plant Training
Patternmaking
4:00 pm Technical Sessions
Malleable
Safety & Hygiene & Air Pollution
(Non-Ferrous)
5:30 pm Exhibits Close
7:30 pm *Annual Banquet*
A.F.S. Gold Medal Awards
Presentation of International Prize
Entertainment

SUNDAY, MAY 4
"International Day"

(Free Day for Employees of Plants in Chesapeake, Philadelphia and Metropolitan Chapter areas)

9:00 am Registration Opens
10:00 am Exhibits Open
International Committee Meetings
Testing Cast Iron
Foundry Defects
A.F.S. Committee Meetings
2:00 pm International Committee of Foundry Technical Associations Meeting
A.F.S. Committee Meetings
4:30 pm *International Reception*
6:30 pm Exhibits Close
7:00 pm *United Kingdom Dinner*

Auditorium of Atlantic City's Convention Hall, which will house exhibits of the



1952 INTERNATIONAL FOUNDRY CONGRESS

MAY 1 THROUGH 7, ATLANTIC CITY, N. J.

MONDAY, MAY 5
"Management Day"

9:00 am — Exhibits Open
Registration Opens
10:00 am — Technical Sessions
Gray Iron
Steel
Safety & Hygiene
Time Study & Methods
Malleable
Sand
National Casting Council Annual Meeting
Foundry Educational Foundation Trustees Annual Meeting
12 noon — Malleable Round Table Luncheon
Defense Production Luncheon Meeting—Ferrous
2:00 pm — Technical Sessions
Educational (Chapter Educational Activities)
Safety & Hygiene & Air Pollution—Ferrous
Plant & Plant Equipment—Non-Ferrous
2:30 pm — Ladies International Tea & Style Show
4:00 pm — Technical Sessions
Gray Iron Shop Course
Sand Shop Course—Ferrous
Education
Costs
Plant & Plant Equipment—Ferrous
5:30 pm — Exhibits Close
7:00 pm — *Alumni Dinner* (By Invitation)

TUESDAY, MAY 6
"Old Timers Day"

9:00 am — Registration Opens
Exhibits Open
Plant Visitation Groups Depart by Chartered Buses

TUESDAY, MAY 6 (CONT'D)

10:00 am — Technical Sessions
Gray Iron
Heat Transfer
Costs
Education
Ladies Sightseeing Trip & Luncheon
Old Timers' Molding Contest
12 noon — Gray Iron Round Table Luncheon
Equipment & Supplies Luncheon
2:00 pm — Technical Sessions
Steel
Time Study & Methods
Refractories
4:00 pm — Technical Sessions
Gray Iron Shop Course
Sand Shop Course—Ferrous
5:00 pm — Ladies Registration Ends
5:30 pm — Exhibits Close
6:30 pm — *International Educational Dinner*

WEDNESDAY, MAY 7
"Exhibitors' Day"

9:00 am — Registration Opens
Exhibits Open
10:00 am — Technical Sessions
Gray Iron
Steel
Sand
11:00 am — *Exhibitor Recognition and Award*
12 noon — Steel Round Table Luncheon
President's Luncheon for FEMA and FFMA Officials
3:00 pm — Registration Officially Ends
4:00 pm — Exhibits Officially Close
Convention Ends

EDITOR'S NOTE: Complete listings of concurrent Plant Visitations in the Atlantic City area, and the program for the week-long Ladies' Entertainment schedule will be published in subsequent issues.

1952 A.F.S. International Foundry Congress & Show the week of May 1 through 7.



When a matchplate is vibrated and withdrawn from the mold, it is believed to be influenced by such factors as passive earth pressure, ratio of induced frequency to the natural frequency of the molding sand mass, and the directional nature of vibrations. These are the conclusions of the author, a former student in the Department of Industrial Engineering, Ohio State University, who studied vibration problems related to molding. Although the data obtained were not extensive, the author hopes that this report will serve as a guide to any researcher who wishes to conduct further investigations of vibration of molding sands.

SOIL MECHANICS AIDS STUDY OF MOLD BEHAVIOR UNDER VIBRATION

Dallas M. Marsh
Foundry Engineer Trainee
Cooper-Bessemer Corp.
Mount Vernon, Ohio

STUDY OF MATCHPLATES AND MOLDS under forced vibration at Ohio State University had a threefold purpose: (1) to observe effects of a pneumatic vibrator on an aluminum matchplate and on the mold in contact with the matchplate under actual working conditions, (2) to use data and observations as a guide in a literature search to determine physical phenomena involved, and (3) to attempt a theoretical explanation of the experiment's results and to present hypotheses and inconclusive results for future consideration.

In order to study the behavior of the matchplate and mold, actual operating conditions were duplicated as closely as possible in the Ohio State Industrial Engineering Department foundry. Equipment used consisted of a jolt-squeeze molding machine, an aluminum slip flask, 12 x 16 in., with 6 in. cope and 4 in. drag depth; an aluminum matchplate containing stadium ash tray patterns; a pneumatic vibrator; and three dial indicators graduated in 0.001 in.

The pneumatic vibrator was attached horizontally to the matchplate (Fig. 1), and a mold made on the molding machine in accordance with standard practice. The plate was then vibrated and the cope lifted off. No data was recorded at this stage of operations, because available equipment was unsuitable for measuring vibrations with the cope in place.

With the cope removed, the aluminum matchplate rested on the top edges of the flask and on the drag half of the mold surface. The drag was not moved from its original position on the molding machine table. Ring stand bases were then clamped to the table, one at each end, and the vertical shafts screwed tightly into the bases. Two dial indicators were affixed to the ring stands, and one clamped to the supporting column of the molding machine squeeze head. Each dial indicator was adjusted so that the foot rested on the matchplate at a specific point. (See Fig. 1).

A number of runs were made with the dial indicators placed in different positions to measure the original position of the plate, the amplitude of vibration in each of the three linear degrees (in line with the movement of the vibrating piston, normal to the piston's line of movement, and vertically), and the matchplate's resting position after vibration. Gage Point, Amplitude and Permanent Displacement dial indicator readings are shown in Table I.

Changes occurring during the periods of vibration could not be measured reliably with the instruments at hand. However, it was possible to measure the upper amplitude of the plate's displacement vertically, and the outer amplitudes horizontally. Amplitude, as used in this report, is the maximum height of the vibration wave, measured from the neutral position.

TABLE I - OBSERVED EXPERIMENTAL DATA FOR A VIBRATED MATCHPLATE RESTING ON THE DRAG HALF OF A MOLD

Gage Point	Amplitude (a_{max})	Permanent Displacement (x)
Horizontal		
11	0.001	0.000
12	0.0035 (erratic)	(not determined)
13	0.000	0.000
Vertical		
21	0.0035	0.001
22	0.003	0.001
23	0.0034	0.001

With the vibrator bolted to the matchplate, as shown in Fig. 1, readings were taken for vertical displacement at three points, while horizontal displacement readings were taken at a different time, using a new mold. A permanent displacement vertically upward was discovered, but what portion of the displace-

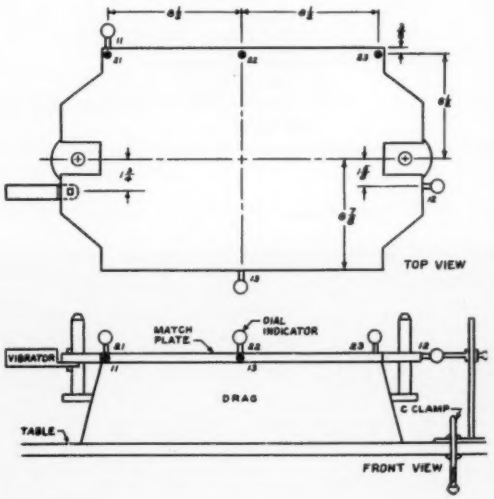


Fig. 1—Experimental setup showing location of dial indicators for measuring matchplate displacement.

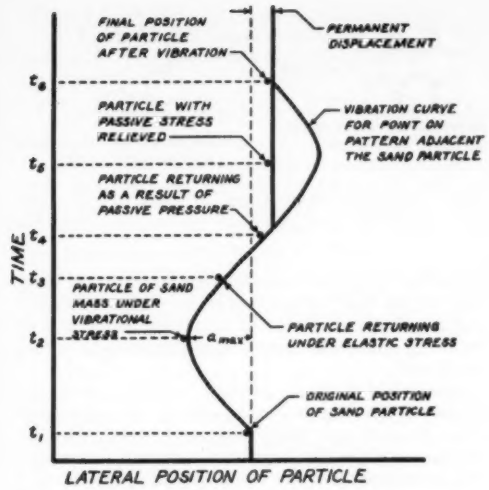


Fig. 2—Proposed explanation of lateral movement of sand particles in contact with vibrating pattern.

ment, if any, was caused by settling of the dial indicators is not known. Precautions were taken to make the ring stand supports tight and rigid, but the ring stand shafts were somewhat flexible.

Reading 22 was made with the dial indicator connected to the molding machine squeeze head column, rather than to a ring stand. Even with this rigid support, an upward displacement of the plate after vibration was observed, indicating that instead of the dial indicators settling, the matchplate was raised by the mold surface.

Displacement In Line With Piston

The horizontal displacement readings showed that the displacement was mostly in a line with movement of the vibrator piston. Several readings were taken at point 12 with the dial indicator in constant contact with the matchplate, so that the dial needle wavered during vibration of the plate. This gave a visual picture of the amplitude which corresponded closely to that observed when the indicator foot was brought carefully and slowly into contact with the vibrating matchplate.

When the indicator foot was allowed to ride the vibrating plate, the foot was permanently depressed at a rate of approximately 0.0014 in. per second, with the needle wavering over an average range of twice the amplitude observed by the other method. Since the dial indicator was attached to the molding machine table, and the mold merely rested on the table, this indicates that pulsations of the vibrator caused the entire mold to creep to the operator's right, or away from the vibrator attached to the matchplate's left end.

A review of principles and theories of soil mechanics and vibration is helpful in understanding physical conditions existing before, during, and after a matchplate is vibrated on a mold face.

For instance, Rankine's theory of earth pressure states that if a retaining wall yields, the backfill of the wall expands in a horizontal direction, then lateral pressure of the soil on the back of the wall gradually decreases and approaches a lower limiting value called active earth pressure. If the wall is forced horizontally toward the backfill, compressing the soil in a horizontal direction, soil resistance increases until it assumes an upper limiting value called passive earth pressure. When either of these two limits is exceeded, plastic flow results.[4]

Terzaghi states that if stresses in a mass of soil are everywhere below the point of failure, the mass is in a state of elastic equilibrium. If the stresses are at the point of failure, the mass is in plastic equilibrium. Stresses beyond the point of failure cause failure of the mass.[4] Plastic flow involves a continuous deformation of the mass under constant stress before the point of failure.

The green sand mold of the experiment is a cohesive

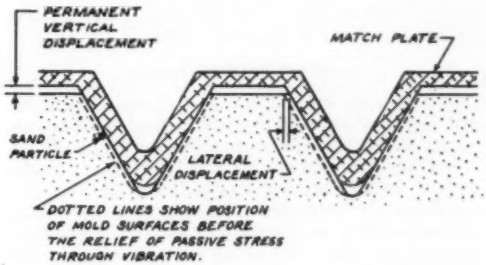


Fig. 3—Probable altered position of mold surface and matchplate due to release of passive pressure in the sand during vibration of experimental mold.

earth mass. The periphery of the mold's drag half, where it was in contact with the flask, was peened to duplicate conventional molding practice for a matchplate containing patterns with projecting sides. In addition the mold was squeezed with the molding machine, and it is conceivable that this created a state of passive earth pressure. The sides of the flask and projecting sides of the patterns served as retainers. Peening and squeezing compressed the molding sand against the upright surfaces, meeting passive earth pressure conditions.

Figures 2 and 3 are based on the assumption that vibration of the matchplate causes a relief of the passive stress in the mold. Figure 2 traces the lateral movement of a particle of the sand mass in contact with the pattern. Amplitude of vertical displacement during vibration was 0.003 in. or more (Table I).

Figure 2 shows a single cycle of vibration for convenience in depicting permanent lateral displacement of the particle. In the particle's original position at t_1 a residual passive stress in the sand mass, built up when the mold was rammed, is opposed by the pattern surface. At t_2 the total stress is intensified because the pattern has moved toward the particle and its surrounding sand mass during the first quarter-cycle of vibration.

At t_3 the particle is returning to its starting posi-

tion under elastic stress. At t_4 the particle has proceeded with the pattern beyond its original position. The supposition is that the pattern surface moves away from the sand surface during the third quarter-cycle of vibration and is followed laterally by the sand mass, because at this phase the pattern's retaining force has been removed and the passive stress in the sand mass can be relieved.

If this is true, particles on the mold surface tend to move a minute distance toward the pattern face during vibration. If pattern sides are vertical, the passive faces on opposite sides of the pattern counteract each other. However, patterns used in the experiment were wedge-shaped, so that passive pressure squeezed the patterns upward during vibration (See Fig. 3). This resulted in a permanent 0.001 in. upward plate displacement.

Since in normal operation the plate would be lifted quickly from the drag, the upward displacement is not in itself significant. It does, however, indicate that passive pressure exists, and possibly causes the described movement of the sand mass.

Damp Sand Causes Bulking

Bulking may account for part of the rise of the plate. Barber[1] states that if damp sand particles are mixed, bulking results, as is shown in Fig. 4. There is considerable adhesion of the sand masses to the pattern faces, otherwise it would not be necessary to vibrate the plate while drawing it. If some sand particles adhere to the pattern surface temporarily, they will be pulled free of the surrounding sand and there will be opportunity for bridging.

The frequency of induced vibration of the matchplate may determine to a large extent whether or not the patterns are drawn from the mold cleanly. Every type of soil has a natural vibration frequency. Some examples of this are shown in Table II.

TABLE II - NATURAL FREQUENCIES FOR VARIOUS TYPES OF SOILS

	Frequency c.p.s.
Loose Sand Agglomeration	17.4
Wet Clay	18.4
Clay with Fine Sand	20.7
Moist Clay	20.8
Moist Medium Sand	21.8

Terzaghi[4] states that if a pulsating disturbing force is applied in resonance with the natural frequency of a vibrating mass, the effect of the successive impulse is additive.

Resonance is expressed in equation form as follows: $\frac{f_1}{f_0}=1$, where f_1 represents the frequency of the disturbing force and f_0 represents the natural frequency of the mass acted upon.

The magnification factor, N, for vibration is expressed as follows: $N=\frac{1}{1-\frac{f_1^2}{f_0^2}}$. For the resonance condition where $\frac{f_1}{f_0}=1$, the equation becomes $N=\frac{1}{1-(1)^2}=\infty$, assuming that there is no damping effect, and further assuming that the object producing the forced vibration constantly bears on the soil mass. This means that for a condition of perfect resonance the amplitude of vibration will increase with time until the sand mass is stressed to the point of failure by shear.

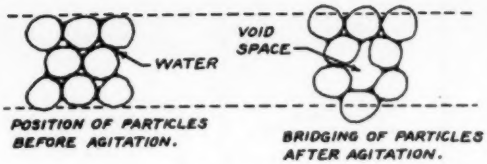


Fig. 4—Barber's explanation of bulking in moist sand resulting from agitation of the sand particles.

The values in Table II show that the natural frequency of molding sand will probably lie in the range from 20 to 25 cps. The frequency of the pneumatic vibrator used in the experiment was not determined but from literature on similar vibrators was assumed to be approximately 5000 vibrations per min, or 83.3 cps. Based on approximations of natural and induced frequencies, the magnification factor is calculated as follows:

$$N=\frac{1}{1-\frac{(83.3)^2}{(25)^2}}=-0.09$$

This value, −0.09, gives an indication that the magnification factor induced by the forced vibrations is quite small. It can be seen that a negative value for N will result when $\frac{f_1}{f_0}$ is less than one. If the induced frequency is greater than the natural frequency of the molding sand, the two are said to be out of phase, i.e., when the force is upward the molding sand moves downward, and vice versa. When the induced frequency is less than the natural frequency, the two are in phase (Fig. 5).[6]

Terzaghi states that the critical range for induced frequencies extends from about $\frac{f_1}{f_0}=0.5$ to $=1.5$, that is, within these limits resonance is approached. For

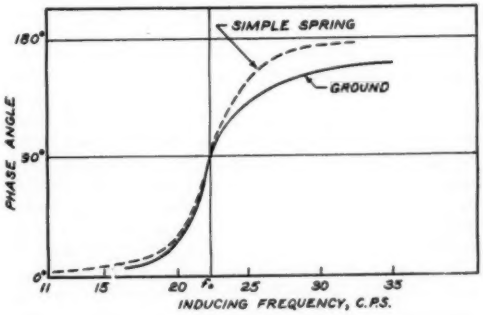


Fig. 5—Phase angle for various induced frequencies acting on a selected soil sample and a simple spring.

the above example the critical range for N would be $-0.8>N>1.33$ and the value obtained, -0.09, is not critical. Notwithstanding these conditions, the author believes that the induced frequencies produced by the vibrators used in molding practice should be investigated to determine whether optimum induced frequencies are being used.

Object of using a vibrator is to free the matchplate and patterns from the mold surface so that they may be drawn without having sand adhere to them. It is possible that if the value for N is too large, sufficient lateral stress could be set up in the molding sand mass to exceed plastic equilibrium and to cause failure by shear of the thin sections, with the result that the sheared sections would adhere to the patterns.

Smooth Surfaces Adhere More Strongly

A lack of any appreciable vibration of the matchplate laterally in a direction normal to the line of movement of the vibrator piston was discovered. Table I shows that at gage point 11 the maximum observed amplitude was 0.001 in., and at gage point 13 no vibration was detected. It follows that on any vertical pattern face parallel to the vibrator piston's line of movement, no pulsations were transmitted to the mold face, unless some slight pulsations were created as the pattern face moved up and down, and back and forth parallel to the mold face in a "rubbing" action.

This rubbing action could conceivably increase adhesion of the pattern and mold faces. If a slick is rubbed lightly back and forth over a green sand mold surface, the surface is smoothed. The same result should pertain to the matchplate patterns used in the experiment. More of a smooth mold surface is in contact with the pattern surface than for a rough mold surface. Since the mold surface is moist, the smoother it is the more strongly it adheres to the pattern surface.

Least Adhesion with Perpendicular Vibration

Proper molding practice calls for removal of the matchplate while the vibrator is operating, so that the plate will jar loose from the mold. If there is a back-and-forth movement in the plane of the surfaces under discussion, there will be stronger adhesion between the surfaces than if the vibration were perpendicular to the surfaces, but less adhesion than if the plate were at rest.

The obvious solution is to have the plate vibrate in all directions simultaneously. It is suggested that future experiments be conducted with two vibrators placed at 90 degrees on the matchplate in order to study the effect of this arrangement on pattern withdrawal from the mold.

Conclusions

1. Instruments better suited to the study of vibrational pulsations and amplitudes should be constructed or obtained for further study of the subject.

2. Passive earth pressure is instrumental in causing a permanent upward displacement of the matchplate on the drag half of the mold when the system is vibrated.

3. The ratio of frequency of vibration of the matchplate to the natural frequency of the molding sand mass can influence the pattern draw quality.

4. Vibration of a matchplate with a single piston-type pneumatic vibrator is directional. Vertical surfaces of the mold face parallel to the vibrator piston's line of movement receive practically no vibrational impulses perpendicular to the surfaces.

Recommendations

It is recommended by the author that further matchplate vibration studies include:

1. A more complete collection of data concerning amplitude of vibration at various points on the matchplate. Data of this report are not extensive enough for specific conclusions.

2. Use of a variable frequency vibrator to determine the natural and optimum induced frequencies for various molding and core sand mixes.

3. Further study of adhesive forces, particularly under conditions of vibrational stress and sliding action of interfaces.

4. Use of two vibrators on a plate, fixed at various angles, but particularly at an angle of 90 degrees to each other.

Acknowledgments

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Stamp Helps Lick Scrap Shortage

THOUSANDS OF STAMPS like the one shown in the accompanying illustration are being distributed by the Steel Founders' Society of America in an effort to relieve the critical shortage of iron and steel scrap. Postage stamp size, these stickers are being made available for use on correspondence and literature distributed by steel foundries to their customers, suppliers and other potential sources of ferrous scrap. SFSA Vice-President F. Kermit Donaldson estimates that nearly a ton of scrap is needed for every ton of steel castings required in national defense work.



"With steel foundries operating at near record production rates, and with practically every pound going to military and defense supporting consumers, it is vital that every single pound of scrap possible be made available," Donaldson said.

GRAY IRON HEAT CONSERVATION

prevent temperature loss from furnace to mold

Ralph A. Clark
Asst. Mgr., Development
Electro Metallurgical Div.
Union Carbide and Carbon Corp.
Detroit

CONTROL OF MANY INDIVIDUAL ITEMS of practice is necessary if the iron foundryman is to produce consistently high quality castings in an efficient manner. Not the least of these is the temperature of the iron as it is poured into the mold.

The importance of pouring metal at a sufficiently high temperature is quite generally recognized. There are a couple of old foundry proverbs to the effect that "good hot iron covers a multitude of sins," or "hot iron eats up the dirt." While the good foundryman certainly does not depend on hot pouring for the elimination of defects caused by faulty molding, it has been demonstrated many times that cold iron and excessive scrap in the form of trapped slag, blows and other miscellaneous defects, not to mention misruns, cold shuts, chilled corners, and chaplet leaks, go together.

On the other hand, excessively hot pouring can result in poor surface due to burned-on sand, as well as more serious defects caused by burned-off chaplets, including raised cores and poor control of dimensions. Obviously, in the production of intricate castings such as automobile cylinders, if chaplets are selected so that the stems fuse satisfactorily at a pouring temperature of, say, 2650 F, pouring metal at a considerably lower temperature may result in leakers due to poor fusion of chaplet stems, whereas pouring at an excessively high temperature may result in melting off these chaplets entirely.

Handling Methods Cause Temperature Loss

Most foundrymen realize the importance of hot metal and take many measures to insure that iron at the cupola spout is at a sufficiently high temperature. However, the burden of getting metal to the molds at a satisfactory temperature should not be carried by the melting department alone. Emphasis has been placed on the adjustment of cupola practice to obtain hot iron, but some plants do not seem to realize that they are throwing away money when they allow inefficient handling methods to cause the loss of some 300 to 400 F in temperature between the cupola spout and the mold.

In many cases, minor changes in handling methods could easily result in substantially reduced temperature loss. A high degree of superheat in the iron costs money, more every year as coke prices increase and good quality coke becomes more difficult to obtain. As the temperature of the metal at the spout is raised, the thermal efficiency of the cupola melting process generally becomes lower, and the foundryman who handles his molten iron in such a manner as to experience an unnecessarily high loss in temperature places an unfair burden on the melting department.

Pyrometry: If pouring temperature is to be controlled within a narrow margin, some method of determining the actual temperature of the metal at the time it is poured is needed. Usually, this means the optical pyrometers, which are of two types—disappearing filament, and optical wedge. The disappearing filament type is probably somewhat more accurate and easily kept in adjustment, but the optical wedge type has the advantage of compactness and convenience in use. Either type of instrument is thoroughly satisfactory when properly used.

Optical pyrometers must be regularly cleaned and checked for accuracy. Too many of them are hung in the foundry office and used only to settle an occasional controversy among plant personnel regarding metal temperature. Such instruments often go uncleaned and unadjusted for long periods, and may be used by men who are unfamiliar with the instrument.

Determining Metal Temperatures

The combination of lack of skill and poor condition of the instrument may make pyrometers used under these conditions worse than useless. It should be stressed that the optical pyrometer must be kept clean and properly adjusted. Also, that it must be used by someone who has the necessary skill and recognizes the limitations of the instrument insofar as smoke, fumes and foundry atmosphere are concerned. Under such control, the optical pyrometer is a valuable tool.

The immersion pyrometer using a noble metal thermocouple is a valuable research tool but, to date, has not been applied extensively for the control of metal temperature under production conditions.

In a few plants a simplified fluidity spiral is used to indicate relative metal temperature on the perfectly plausible theory that "if it runs far enough, it is hot enough." The technique of pouring such molds must be carefully standardized but, when the proper precautions are taken, the fluidity spiral can be a useful indicator of pouring temperature as well as fluidity as influenced by the analysis of the iron.

Not to be neglected is the eye of the foreman or skilled metal pourer. Particularly when guided by occasional pyrometer readings, a skillful man can be uncannily accurate in estimating metal temperature.

Control of Temperature Loss: Loss of temperature between the time the metal leaves the tap hole of the cupola and enters the mold can be traced to many causes. Obviously, any heat lost by the iron is picked up by the foundry atmosphere and, if in some manner we were able to handle iron under conditions which would prevent this transfer of heat, metal would enter the mold at the same temperature it leaves the cupola.

Major losses of temperature might be classified as

NOTE: This paper was presented at a Gray Iron Shop Course session of the 55th Annual Meeting. American Foundrymen's Society, at Buffalo, Apr. 23-26, 1951.

Careful analysis of metal handling methods and minor changes in existing equipment can result in substantial reductions in the 300 to 400 F temperature losses experienced in many foundries. Such simple measures as covering the cupola spout and providing covers for receiving and transfer ladles have proved effective in reducing melting costs and delivering metal to the mold at the proper pouring temperature.

follows: (1) tapping or spout losses; (2) transfer losses; and (3) ladle losses.

Tapping Losses: Tapping or spout losses usually are overlooked but can be appreciable, particularly with intermit tapping of small cupolas. Such cupolas usually tap at infrequent intervals. The amount of metal at a tap is small, and the tap hole which fixes the size of the metal stream usually is of small diameter. Many cupolas are installed with unusually long troughs which contribute to such losses. Tapping losses can be minimized by:

(1) Using as large a tap hole as is practical, resulting in a rapid tap and transfer to the ladle.

(2) Lining the trough fairly narrow, and with a rounded bottom to maintain a compact stream of metal. A thin sheet of metal spread over the bottom of a trough with a wide, flat bottom results in unnecessary temperature losses.

(3) Covering the trough with brick to minimize radiation losses of heat from the metal and from the refractory lining between taps.

(4) Bricking up the end of the trough so that the metal passes through a small hole in the bottom will help prevent circulation of cold air up through the trough and maintain its temperature between taps.

(5) A satisfactory slope so that the metal gets down the trough into the ladle rapidly is also advisable.

These points, taken individually, may seem to be minor, but careful attention to all of them can result in enough better temperature in the ladle to make such care very worthwhile.

Transfer Losses: Transfer of metal from the cupola spout to a ladle or from ladle to ladle results in a very appreciable temperature loss. This is particularly true in the case of open ladles because of the tendency of the refractory to cool off rapidly between fillings. In such cases the metal must reheat the refractory lining each time the ladle is filled. Personal experience has indicated that a 1-ton ladle of the conventional open type, which is used on a regular schedule of a cycle each 5 to 6 min, will be responsible for a temperature loss of 100 F. when filled at the cupola spout. In other words, metal at a spout temperature of 2800 F will be 2700 F immediately after the ladle is filled.

This ladle, with a conventional lining of split fire brick, usually carried back a small drop of over-iron, but also probably returned to the cupola at a somewhat higher temperature than is normal in the average foundry. This loss of 100 F is believed to be typical. It can be cut roughly in half by equipping the ladle with a cover which prevents excessive cooling of the refractory during return to the cupola. As an alternative to the use of covered ladles, a very thin rammed ladle lining of high temperature refractory reduces the amount of refractory material which must be reheated each time the ladle is used. In this case, a saving of approximately 25 per cent of the temperature loss experienced with the conventional split brick lining can be made.

It should be stressed that in the conventional open ladle, the rferactory cools rapidly as the metal is poured out, and must be reheated each time the ladle is filled. It is believed that the conservation of temperature obtained by the use of covered ladles is more a question of conserving the heat in the refractory lining between fillings than prevention of radiation from the metal during the time the ladle is full. In the covered ladle cooling of the refractory between fillings is materially reduced, resulting in metal that is some 50 F higher in temperature after leaving the cupola.

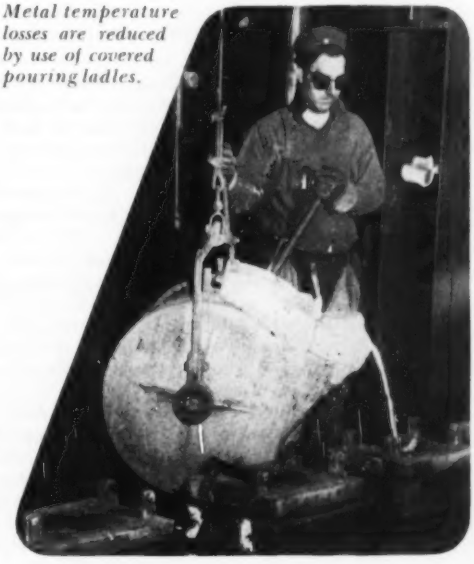
In the case of the thin lined open ladle, the quantity of the refractory which must be reheated is reduced, resulting in a lower temperature loss.

Ladle Heat Wasted

Obviously, if covered ladles are to be used to the greatest advantage, they should be kept closed until refilled. In many cases such ladles wait for metal at the cupola with the lids thrown back. This thoughtless waste of heat results in an excessive loss of temperature due to unnecessary cooling of the refractory.

Practices in which the metal is rehandled two, three, or even four times, from the cupola to the mold are not uncommon. Such rehandling may consist of tapping from the cupola into a receiver, pouring into a distribution ladle, and finally to a smaller pouring ladle. Unless such handling systems transport an unusually large quantity of metal, thus keeping the ladles at a high temperature, there is bound to be excessive temperature loss between the furnace and the mold.

The remedy for such losses is to arrange the han-



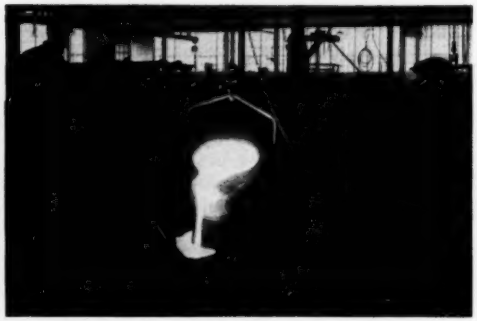
Metal temperature losses are reduced by use of covered pouring ladles.

dling system to eliminate transfer of metal from one ladle to another wherever possible, and use covered and insulated ladles where this equipment is practical. Some foundries using covered pouring ladles on light work find it an advantage to bring such ladles directly to the cupola for refilling, thus almost eliminating the temperature loss which results from each reladling of the metal.

Ladle Losses: For the purpose of this discussion ladle losses will be limited to the loss of temperature after iron is in the ladle or receiver. Such temperature loss is caused by radiation of heat from the metal to the atmosphere, either through the refractory of the ladle lining or from the surface of the metal in the ladle. The rate of such heat loss is affected by many factors. The principal ones are:

(1) Size of ladle. Large ladles present less surface area in proportion to their capacity than small ladles, and metal held in them will lose temperature less rapidly.

(2) Covering of the ladle. Provision of a cover for the ladle prevents a great deal of radiation of heat to



Heat losses from open ladles are due to the tendency of the refractory to cool rapidly between fillings.

the atmosphere and will delay cooling of metal in the ladle after it is filled. This is in addition to the control of temperature loss from the refractory when the ladle is empty. Thus, covering the ladle reduces temperature loss by two distinctly different methods.

(3) Provision of insulation between the refractory and ladle shell will cut down radiation losses through the refractory.

(4) Proper preheating will help prevent excessive loss of temperature on the first few ladles handled.

Actually, ladle losses as contrasted to transfer losses are rather small. This is particularly the case in large ladles, as can be attested to by anyone who has waited while a ladle of excessively hot metal cooled sufficiently for pouring a large casting.

Forehearths or Receivers: It is generally realized that the receiver has many useful functions in the cupola melting department. It provides for increased uniformity of metal composition, but such equipment can also result in what may be very serious losses in metal temperature.

The following figures have been reported as representative of temperature losses in a 3-ton elongated receiving ladle of typical design operated approximately one-half full: tapping temperatures of 2650 F, 2700 F, and 2750 F had losses in the receiver of 80 F, 100 F, and 120 F, respectively. These are average figures taken after the unit was in operation. Another small receiver of 1½-ton capacity, handling 16 tons per hour, is reported as responsible for a temperature loss of 40 F to 60 F.

Such temperature losses are a severe handicap in using receiver equipment when producing light-section castings. When the unit is not thoroughly preheated, the loss in temperature early in the heat may be double or even treble this figure. Older types of open receiving ladles also show metal temperature losses considerably higher than those quoted above.

When operating receivers, metal temperature loss can be minimized by:

(1) Balancing the equipment with the melting rate of the cupola. It should hold no more than a 15-min accumulation of iron. The faster the metal goes through a receiver the less the temperature loss. In other words, a receiver which is handling approximately 10 tons per hour and showing a temperature loss of 100 F, would show a loss somewhere in the neighborhood of 50 F if the same unit were used on a large cupola melting 20 tons per hour. The lower temperature loss may at times be more important than the advantages of mixing a larger volume of metal.

(2) Provision of adequate preheating facilities in the form of a large gas or oil torch. The receiver should be as hot as possible when first filled. This is a critical period of the heat, and low-temperature metal is particularly serious at this time.

(3) Elimination of the obsolete uncovered type of receiving ladle.

(4) In using covered receivers, keep the openings in the cover as small as practical. Many of these receivers have about one third of the top open at the point where the metal enters the receiver. A narrow slot for the introduction of metal will do just as well and cause less temperature loss.

(5) The writer believes that the design of some of these receivers could be improved. For instance, where desulphurizing is not performed, the elongated type of ladle could probably be shorter and of somewhat greater diameter, resulting in a more compact bath. The more compact the metal bath, and the less surface presented to the refractory and atmosphere above the metal, the lower will be the temperature loss.

(6) When using a receiver, it may be well to take advantage of the somewhat higher temperature metal obtained from the cupola when front slagging is used, compared to the conventional intermittent tapping.

While many of the items mentioned are small parts of the whole picture, in the aggregate they can add up to an abnormally large loss in the temperature of metal from the time it leaves the cupola until it enters the mold. Summarizing these points, to conserve all possible temperature in the metal from the intermittently tapped cupola:

(1) Watch the tapping practice. Use a reasonably large tap hole and provide the cupola with as short a covered spout as practical, lined to form a compact

stream and with sufficient slope to get the metal down the trough and into the ladle rapidly.

(2) Carefully preheat receivers and ladles.

(3) Avoid transfer of the metal from one ladle to another whenever possible.

(4) Utilize well designed covered and insulated ladles for transfer of metal and pouring where practical, handling these ladles in such a manner as to conserve heat.

A little attention to these few details will pay big dividends in any foundry producing light-section work. Neglect of them can mean serious trouble, as has been demonstrated many times.

Cooling of Metal: Under the subject of control of temperature comes the cooling of metal which is too hot, as well as the conservation of metal temperature. This problem can be almost as big a headache as cold iron. Any foundryman producing heavy work can vouch that it takes a long time for a ladle of excessively hot iron to cool. Metal can be cooled to a suitable pouring temperature in several ways:

(1) It can be left to cool in the ladle, a slow procedure in large ladles and one that may interfere with production continuity or melting rate of the cupola.

(2) Additions of cold scrap, either iron or steel, can be made in the ladle. An addition of one pound of scrap per ton of metal will reduce the temperature about 1 F: 50 lb of scrap per ton will mean a 50 F reduction. Any scrap used for this purpose should be clean, dry and free of rust. The writer dislikes the practice of adding cast iron scrap, feeling that it opens up the structure of the iron and tends to cause internal porosity defects in some castings. Clean steel scrap may not be objectionable and, where the metal is both too hot and too soft for a heavy casting, a ladle addition of steel scrap may be a convenient method of improving the structure as well as controlling the temperature.

(3) Metal can be reladled. Pouring from one ladle into another colder ladle will result in a substantial and rapid decrease in temperature of some 100 F, depending on the volume of the metal and the temperature of the ladle involved in the transfer.

(4) A minor reduction in metal temperature can be obtained by bringing back a portion of the preceding tap when the ladle is returned to the cupola for refilling. Whether this measure is practical will depend on conditions in a given shop.

Special Equipment for Metal Temperature Control: Thus far, only the methods of temperature control which can be practiced by any foundry have been presented. In some cases, these methods are more suitable for the jobbing type of foundry than the high production plant. Many methods of obtaining accurate control of the temperature of the iron as it enters the mold have been devised for the use of the high production foundry. These include the elaborate pouring system adopted by a couple of high production plants in which metal is transferred directly from a melting or holding furnace to molds on a conveyor which loops in front of the furnace. In these cases, each mold is poured at the temperature of the metal issuing from the furnace, and this temperature can be easily maintained mold after mold on round-the-clock operation.

Other plants have installed electric furnaces in place of the usual cupola forehearth or receiver. Metal may be tapped directly into the furnace from the cupola, or may be transferred by ladle. The electric furnace usually carries a large bath and, in addition to improved temperature control, such installations make possible accurate adjustment of analysis. In a foundry feeding metal directly to a high production conveyor, such accurate control of tapping temperature results in almost equally accurate control of temperature at the mold.

Another less ambitious scheme has been used by at least one of the smaller foundries. In this case, cupola metal is transferred to a powdered-coal-fired holding furnace located at the pouring station on a conveyor line. This unit does not materially increase the temperature of the metal contained in it, but does prevent a temperature loss and certainly helps promote uniformity of both chemical composition and temperature of the metal reaching the mold.

Examine Handling Methods

Such schemes, no doubt, involve an excessive capital investment for the smaller foundry, but a careful analysis of handling methods to insure most efficient use of existing equipment will still pay big dividends in many plants, and may suggest modifications in practice which could result in improved operation. It might be well for the individual foundry manager to make a critical examination of his metal handling.

This matter is most serious in the case of foundries making light-section castings. The foundry producing this type of work, which is set up to bring covered ladles directly to the cupola for filling and to pour molds from the same ladles, has a distinct advantage compared to the plant which must reladle metal one or more times. Handling metal through an open transfer ladle and using open pouring ladles or hand ladles at the molding floor will cause the latter plant to experience some 200 F greater loss in iron temperature.

Such temperature losses cost money. They may make necessary the use of excessively large quantities of cupola fuel, and certainly a little difficulty in the melt department can readily put such a light-casting foundry in serious difficulty. Even simple expedients such as the equipping of transfer ladles with homemade covers can make a big difference in the temperature of the metal received at the pouring floor. The glare of white-hot metal in open ladles may lend a certain amount of glamour to the foundry scene, but only at the price of wasted efficiency, danger of increased scrap losses, and unnecessary discomfort for the foundry personnel.

New, Smaller A.F.S. Pins Available



Contrasted here in actual sizes are the old A.F.A. pin and the new, smaller A.F.S. pin, reduced in size by popular demand of members of the Society. The new 3/8 in. diameter A.F.S. pins will be traded for the old American Foundrymen's Association pins at no extra cost or are available at $1 each from the American Foundrymen's Society National Office, 616 S. Michigan Avenue, Chicago 5, Illinois.

PURDUE AND QUAD CITY REGIONALS SCHEDULED EARLY IN NOVEMBER

MIDDLE WEST will be the scene of two A.F.S. Regional Foundry Conferences early in November—the Purdue Metals Casting Conference at Purdue University, West Lafayette, Ind., November 1 and 2, and the Quad City Foundry Conference at the Blackhawk Hotel, Davenport, Iowa, November 8 and 9. Scheduled for October 19 and 20 at the Shamrock Hotel, Houston, is the Texas Regional Foundry Conference. Sponsored by the A.F.S. Texas and Texas A & M Student Chapters, the program for this event was reported in the September, 1950, issue of AMERICAN FOUNDRYMAN.

Purdue Metals Casting Conference

Held for the fourth time at Purdue University will be the Metals Casting Conference, November 1 and 2, sponsored by Purdue University in cooperation with the A.F.S. Central Indiana and Michiana Chapters. Conference Committee is headed by Robert Spurgin, III, Swayne, Robinson & Co., Richmond, Ind., with C. T. Marek, Department of General Engineering Purdue University, as vice-chairman, and R. W. Lindley, Department of General Engineering, Purdue, as Conference secretary. Program Chairman for the Conference is L. D. Reiff, Superior Steel & Malleable Casting Co., Benton Harbor, Mich.

PURDUE METALS CASTING CONFERENCE PROGRAM

Thursday, November 1

9:00 am REGISTRATION

10:00 am GENERAL MEETING. A. A. Potter, Dean, Purdue University Schools of Engineering, *"University's Interest in Industry."* A.F.S. National Vice-President I. R. Wagner, *"Industry's Interest in Education."* Ernest H. Reed, International Harvester Co, Chicago, *"Evaluation and Training of Personnel for Industry."*

12:30 pm LUNCHEON.

1:30 pm TECHNICAL MEETING. John C. Pennock, Tracerlab, Inc., Boston, *"Looking Inside Castings with Atomic Energy."*

3:00 pm TECHNICAL MEETING. Royal G. Tobey, Eastman Kodak Co., *"The Practical Side of Non-Destructive Testing with Corrective Measures."*

OPEN HOUSE AT PURDUE FOUNDRY

6:30 pm CONFERENCE BANQUET. Speaker, E. A. McFAUL, Northwestern University, *"How Confused Can We Get?"*

Friday, November 2

10:00 am TECHNICAL MEETING. Film, *"The A-D-M of Cores,"* W. B. Bishop, Archer-Daniels-Midland Co., Cleveland.

11:00 am TECHNICAL MEETING. Walter Jaeschke, Whiting Corp., Harvey, Ill., *"Sources of Trouble in Cupola Operation."*

12:15 pm LUNCHEON.

1:30 pm TECHNICAL MEETING. R. W. Gardner, Ford Motor Co., Dearborn, Mich., *"Practical Quality Control."*

2:30 pm TECHNICAL MEETING. Film, *"Mechanization in Molding,"* Harold Weimer, Beardsley & Piper Co., Chicago.

3:30 pm CONFERENCE SUMMARY. Paul Harlan, Electric Steel Casting Co., Indianapolis.

Quad City Regional Conference

First A.F.S. Quad City Regional Foundry Conference, sponsored by the A.F.S. Quad City Chapter, will be held November 8 and 9 at the Blackhawk Hotel, Davenport, Iowa, and will have as its theme, *"Better Castings Through Knowledge"*

Chairman of the Conference is A. D. Matheson, French & Hecht Division, Kelsey Hayes Corp., Davenport, with W. C. Bell, Frank Foundries Corp., Moline, Ill., as co-chairman. Eric Welander, Union Malleable Iron Works, East Moline, Ill., is program director, and R. E. Miller, John Deere Planter Works, Moline, is Conference secretary.

Conference Committee members are Boyd L. Hayes, Union Malleable Iron Works, East Moline; C. R. Marthens, Marthens Co., Moline; C. S. Humphries, C. S. Humphries Aluminum Foundry, Moline; Harold Rasmussen, General Pattern Corp., Moline; Clifford Erikson, Frank Foundries Corp., Moline; and A. H. Putnam, A. H. Putnam Co., Rock Island, Ill.

Registration, according to Conference Chairman W. C. Bell, will be $12.00 for the entire Conference and will include six technical sessions, two luncheons and the Banquet. Those wishing to attend may register in advance by writing Conference Secretary-Treasurer R. E. Miller, John Deere Planter Works, Moline, Ill. Room reservations must be made directly with the management of the Blackhawk Hotel.

QUAD CITY REGIONAL CONFERENCE PROGRAM

Thursday, November 8

9:00 am REGISTRATION.

10:00 am GENERAL MEETING. Opening address by A.F.S. National President Walter L. Seelbach.

10:45 am GENERAL MEETING. George K. Dreher, Foundry Educational Foundation, Cleveland, *"You Can Help."*

12:15 pm LUNCHEON. Speaker, John T. Brown, J. I. Case Co., *"Importance of Supervision in Today's Problems."*

2:00 pm TECHNICAL MEETING. Walter Jaeschke, Whiting Corp., *"Cupola Practice."*

3:40 pm TECHNICAL MEETING. Emil Schmidt, Studebaker Corp., *"Foundry Mechanization."*

6:30 pm CONFERENCE BANQUET. Speaker, Col. Jack Major, *"Taxes, Women and Hogs."*

Friday, November 9

9:00 am REGISTRATION.

10:00 am TECHNICAL MEETING. Zigmund Madacey, Caterpillar Tractor Co., *"Modern Methods of Producing Cores."*

12:15 pm LUNCHEON. Speaker, Col. W. W. Warner, Commandant, Rock Island Arsenal, Rock Island, Ill., *"The Arsenal's Role in National Defense."*

2:00 pm TECHNICAL MEETING. John B. Caine, foundry consultant, Wyoming, Ohio, *"What Do We Know About Sand?"*

3:40 pm TECHNICAL MEETING. Robert P. Schauss, Werner G. Smith, Inc., *"Gating and Risering."*

WOOD *for* PATTERNS

E. M. Davis, Technologist
Forest Products Laboratory,* Forest Service
U. S. Department of Agriculture

Types of woods suitable for pattern purposes, properties, and methods of processing are described in this article. Moisture contents of pattern woods, shrinkage upon kiln or air drying, and drying to a point of equilibrium with the atmosphere are important factors.

FEW WOOD PRODUCTS are so small in volume and at the same time of such great importance as patterns. Only about two boards out of every thousand produced at the sawmill are consumed by the patternmaker, but these two are highly important to the foundryman, to the machine manufacturer and, indirectly, to the consumer. Parts of automobiles, oil burners, sewing machines, electric refrigerators and household equipment require patterns at some stage of manufacture.

Just any wood will not do for patterns. A good pattern wood must have low shrinkage so that (once it has been properly dried) changes in dimension caused by the moisture in the air will be negligible. It must also be low in warping tendencies so that it will hold its shape. Good nail-holding power and the ability to take nails close to the edges are desirable.

Light weight makes for greater ease in handling large patterns, but it should be combined with a moderate degree of strength. The good pattern wood should also have enough resistance to wear to permit re-use many times. Good machining properties are essential, that is, it should be possible to cut the wood smoothly at all angles to the grain with common woodworking tools, provided reasonable care is used. Another requirement is the ability to form strong glue joints without undue difficulty.

Wood Species and Quantities Used

Figures for 1948 show that 69 million feet were used for patterns in that year, and 36 million feet for flasks. This paper is limited to pattern lumber, which is much the more exacting use of the two.

Eighty-four per cent of the woods used for patterns are native softwoods, including 78 per cent of soft pines, chiefly eastern white pine and sugar pine. Several native hardwoods are used on a small scale, principally maple and basswood. Mahogany has the properties desired for pattern woods and comprises 8 per cent of the total wood used for this purpose, or slightly more than the percentage for all native hardwoods. It is the only foreign wood used in any significant volume. Consumption of various species for patterns and models for the year 1948 is listed in the table.

The preferred pattern woods have certain similarities in grain and structure. The end grain of eastern white pine as seen under a microscope (Fig. 1) illustrates some of these features. The wood consists largely of thin-walled cells with relatively large openings. These are the springwood cells. Each year's growth

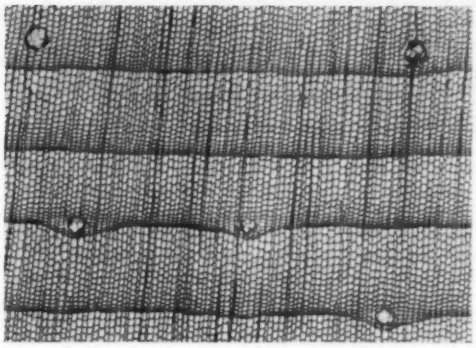


Fig. 1—Photomicrograph of end grain of eastern white pine shows the cell structure typical of a lightweight, uniform, and homogeneous wood. Large openings are resin ducts. Sugar pine has similar structure.

also includes a few rows of summerwood cells with thicker walls and much smaller openings. This type of structure makes for a relatively lightweight, uniform, and homogeneous wood. The few large-sized openings are the resin ducts through which the natural resin circulates in the tree. The structure of sugar pine is similar to that of eastern white pine.

Green wood may have a moisture content of 30 to 300 per cent, depending on the species and on whether the wood is heartwood or sapwood. Sapwood typically has higher moisture content than heartwood.

Water is held in wood in two ways: (1) free water in the cell cavities; (2) imbibed water in the cell walls. As the wood dries, the free water leaves first. The fiber saturation point is the point at which all the free water is gone and all the imbibed water remains. This is usually about 30 per cent moisture content. It is

WOODS USED FOR PATTERNS AND MODELS IN 1948

Softwoods	M feet	Hardwoods	M feet
Pine:		Maple	1,976
Eastern white	27,579	Basswood	1,361
Sugar	19,158	Yellow-poplar	738
Ponderosa	3,897	Oak	485
Western white	3,412	Birch	290
Southern yellow	2,597	Cherry	230
Spruce	460	Black walnut	92
Douglas-fir	429	All other native hardwoods	137
All other softwoods	292	Total native hardwoods	5,309
Total softwoods	57,824	Mahogany	5,825
		Other foreign hardwoods	57
		Total foreign hardwoods	5,882
Total of all species	69,015,000 FBM		

*Maintained at Madison, Wisc., in cooperation with the University of Wisconsin.

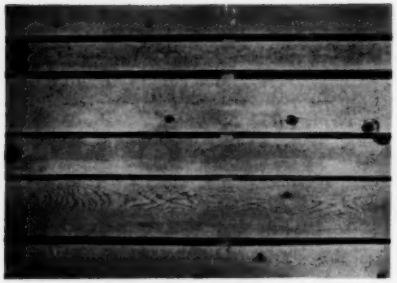
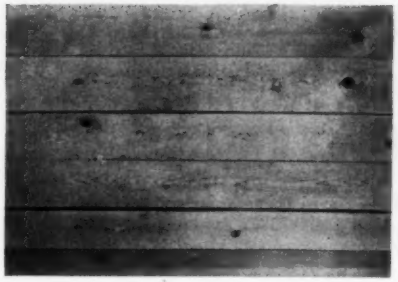


Fig. 2—Examples of No. 1 Shop (left) and Factory Select (right) grades of ponderosa pine which are largely used for patterns.



important, because it is the point at which shrinkage begins. Most of the water may actually be dried out of a board before it starts to shrink.

Eastern white pine, which is one of the low-shrinkage woods, shrinks about 4 per cent in volume when dried from green to 12 to 15 per cent moisture content, about 6 per cent from green to 6 to 7 per cent moisture content, and about 8 per cent from green to oven-dry. Under conditions of actual use, lumber seldom gets drier than a moisture content of 6 to 7 per cent and, for all practical purposes, 6 per cent shrinkage in volume is about as much as is ever obtained.

For patterns, as for other uses, it is desirable to dry lumber to the equilibrium moisture content. This is the point at which the moisture content of the wood is in balance with that of the surrounding air. It will vary at different seasons, but is usually about 6 to 8 per cent in heated buildings in the winter.

Protective coatings on patterns, such as paint and shellac, will retard changes in moisture content, but will not entirely prevent them during long periods of either abnormal wetness or dryness.

"Air Dry" Varies With Locality

Few dry kilns are operated at mills that saw eastern white pine. Unless commercial kiln drying is available, therefore, it is usually necessary to buy this wood in an air-dry condition. Air dry is a somewhat elastic term because of different climatic conditions in different parts of the country. Lumber in some parts of the West may air dry to 10 per cent moisture content in the summer, while in the Lake States about 15 per cent would be the minimum.

Practically all large mills that saw sugar pine and ponderosa pine have dry-kiln capacity sufficient for the "Select" and "Shop" grades. The term "kiln dried" should be related to a definite moisture content; otherwise it merely means that the lumber in question has been put in a kiln and dried to an indefinite degree. For pattern purposes, a moisture content of not more than 8 per cent is probably desirable. For dry wood, storage in a heated, ventilated room is advisable.

The grades of lumber required for patterns vary according to the types and sizes of patterns made. In the pines, Select and Shop grades are chiefly used.

The best pieces in the select grades are entirely clear. The poorest pieces admit a few small defects. In general, however, the select grades consist of boards that are suitable for use as a whole. Their chief use is in patterns of a type that requires clear material in large sizes. The best grade of select described in specifications is B and Better. In recent years, however, an increasing number of mills have been combining B and Better with C Select, with C and Better as their best grade. The lowest select grade is D Select.

The pine grades used in largest volume for patterns are the shop grades. These run from 5 to 24 in. in random widths, mostly 1¼ in. and thicker. Shop grades were originally intended to be cut up for manufacture into sash and doors. The best of these grades, Factory Select, is illustrated in Fig. 2. Like all shop grades, this one is characterized by a few coarse defects with areas of clear wood between. Poorer shop grades have more numerous defects and smaller clear areas.

The Factory Select grade is required to yield 70 per cent of its area in door cuttings as compared with 50 per cent for the next lower grade, No. 1 Shop. No. 2 Shop requires only 25 to 40 per cent of door cuttings, according to the quality of the cuttings.

The grades of No. 1 Common and No. 2 Common are sometimes used where knots are allowable. Knots in these grades are numerous but are sound, tight, and small to medium in size. Common grades come mostly in 4- to 12-in. widths and 1-in. thickness.

Mahogany is sometimes used for patterns that are to receive somewhat harder than average use. This wood is graded under the rules of the National Hardwood Lumber Association, and the pinwormy grades are the ones used for patterns as a rule. Pinwormy mahogany is made in three grades: Firsts and Seconds, No. 1 Common, and No. 2 Common. These differ little from the standard grades of the same name except that they allow pinworm holes within certain limits.

Housing Fund Subscriptions Continue

Donations to the A.F.S. Building Fund for a permanent home for the American Foundrymen's Society are still coming in. Although active solicitation of funds has ceased, a number of individuals, chapters and companies have increased their original contributions or have become charter subscribers within recent months. Plans for the $140,000 (to date) permanent home for the Society are well under way, with Chicago vicinity chosen as the site, and architects and plans now being selected.

CHARTER SUBSCRIBERS

(August 20 - September 20)

CHAPTER CONTRIBUTORS

Texas Chapter

INDIVIDUAL CONTRIBUTORS

American Society for Metals, Cleveland.
Rochester Erie Foundry Co., Rochester, N. Y.

FORMULATE PLANS FOR INDUSTRY-SPONSORED SAFETY & HYGIENE & AIR POLLUTION PROGRAM

INDUSTRY-WIDE BACKING of a 10-year Safety & Hygiene & Air Pollution Program for foundries was outstandingly evident as representatives of every segment of the metal castings industry, members of the newly constituted A.F.S. Safety & Hygiene & Air Pollution Committee, met at Chicago's Congress Hotel September 24 to work out details of the program.

"The time has come when the foundry industry must determine whether it will lead or be led in formulating safety, hygiene and air pollution control practices for the metal casting industry," Committee Chairman James R. Allan, International Harvester Co., Chicago, said in opening the meeting. Foundry management, he added, must be educated to recognize and correct safety, hygiene and air pollution hazards within its own industry, before outside non-industrial groups force corrective measures upon it.

Chairman Allan introduced A.F.S. Technical Director S. C. Massari, who expressed pleasure in having the foundry industry so well represented. Interest in these important phases of the industry has been growing rapidly in the past few years, Mr. Massari said, so much so that in 1950, the A.F.S. Board of Directors voted for the reestablishment and expansion of its past programs.

Committee members, representing many components of the metal castings industry, when called upon to state whether they believe there is a definite need for such a program, were unanimous in the opinion that development of engineering standards for Safety & Hygiene & Air Pollution would mean one of the most significant forward steps in foundry history.

First step in the program, the committee decided, will be to review and revamp existing Safety & Hygiene & Air Pollution codes. It was also recommended that the term "codes" be eliminated in favor of "recommended safe practices" or "suggested safe practices." Particularly in need of early attention, it was suggested, are problems involving sand systems, ventilation of melting furnaces, fume control for core ovens, noise problems in cleaning rooms, dust control in pattern shops, and maintenance of dust systems.

Small Foundries a Major Consideration

Committee members emphasized the need for directing the program to the small foundry's problems as well as to the larger plants. The committee, as an indication of its interest in directing a major share of its effort toward the small plant, voted to appoint two representatives from small foundries to the steering committee for this purpose. One would represent ferrous foundries and the other non-ferrous.

Several committee members said that their companies have collected technical data on dust control and air pollution, and suggested that this data be gathered and reviewed by the committee and made

Representatives of a wide segment of the foundry industry attending the September 24 meeting of the A.F.S. Safety & Hygiene & Air Pollution Committee are, clockwise from lower left: Dr. J. C. Chivers, Crane Co.; James A. Purdy, Michigan Mutual Liability Co.; F. A. Patty, General Motors Corp.; H. H. Moore, V. Duranceau and J. P. Radcliffe, all of Ford Motor Co.; J. M. Kane, American Air Filter Co.; A. G. Granath, National Engineering Co.; A.F.S. Safety & Hygiene & Air Pollution Program Director Kenneth M. Morse; Committee Chairman James R. Allan, International Harvester Co.; A.F.S. Technical Director S. C. Massari; Kenneth Smith, Caterpillar Tractor Co.; A.F.S. National Secretary-Treasurer Wm. W. Maloney; W. O. Vedder, Pangborn Corp.; Dr. L. Hamlin and Edwin J. Wallman, both of American Brake Shoe Company; Dr. Dudley A. Irwin, Aluminum Company of America; and C. C. Sohl, American Steel Foundries.



available to the foundry industry. Equal emphasis, it was agreed, must be placed on safety, since statistics prove that this is one of the foundry industry's most vital problems.

Medical members of the committee urged that sound medical opinion be taken into consideration in preparing recommended engineering practices. The committee agreed that this is essential and appointed a medical sub-committee to be headed by Dr. Dudley A. Irwin, Aluminum Co. of America.

Kenneth M. Morse, newly-appointed staff director for the Safety & Hygiene & Air Pollution Program, outlined the contemplated program for the industry and the committee approved the points discussed. As an immediate project, Chairman Allan suggested that a foundry welding code be developed, since he has already laid the groundwork for one.

The committee further decided that all publications it develops in the fields of safety, hygiene and air pollution be made available at a nominal price to insure wide distribution. Sub-committees will be appointed in the near future and member companies will be contacted to find whether they have men on their staffs who can and will contribute to the Safety & Hygiene & Air Pollution Program.

$350,000 Needed for 10-Year Program

Concluding the meeting, A.F.S. National Secretary-Treasurer Wm. W. Maloney outlined the formula upon which solicitation of funds for the Safety & Hygiene & Air Pollution Program will be based. The committee approved the formula, which will enlist the cooperation of the foundry industry in raising $350,000 within three years to carry out a 10-year program. Mr. Maloney also stated that an interesting Safety & Hygiene & Air Pollution series of technical meetings is being developed for the 1952 A.F.S. International Foundry Congress next May in Atlantic City.

Committee Represents Entire Industry

Committee members and invited guests attending the meeting were: Chairman James R. Allan, International Harvester Co., Chicago; Dr. J. C. Chivers, Crane Co., Chicago; F. A. Patty, General Motors Corp., Saginaw, Mich.; H. H. Moore, V. Duranceau and J. P. Radcliffe, all of Ford Motor Co, Dearborn, Mich.; James A. Purdy, Michigan Mutual Liability Co., Detroit; J. M. Kane, American Air Filter Co., Louisville.

A. G. Granath, National Engineering Co., Chicago; Kenneth Smith, Caterpillar Tractor Co., Peoria, Ill.; W. O. Vedder, Pangborn Corp., Hagerstown, Md.; Dr. Dudley A. Irwin, Aluminum Co of America, Pittsburgh; C. C. Sohl, American Steel Foundries, Chicago; and Dr. L. Hamlin and Edwin J. Wallman, both of American Brake Shoe Co., New York.

A.F.S. Staff members present were National Secretary-Treasurer Wm. W. Maloney, Technical Director S. C. Massari, and Kenneth M. Morse, Safety & Hygiene & Air Pollution Program director.

Unable to be present was H. A. Forsberg, Continental Foundry & Machine Co., East Chicago, Ind. Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio; and Chester K. Faunt, Christiansen & Olsen Foundry Co., Chicago, were elected members of the committee at the meeting.

Schedule Tours of A.F.S. West Coast Chapters for Top Foundry Speakers

EIGHT PROMINENT FOUNDRYMEN and foundry suppliers are available to speak at the five A.F.S. West Coast Chapters this season, according to a schedule arranged by A.F.S. Technical Director S. C. Massari at the joint request of the chapters.

The speakers will deliver technical talks consecutively at the Southern California, Northern California, Oregon, Washington and British Columbia Chapters,



I. R. Wagner



W. B. Bishop

beginning with the September and ending with the April meetings. The speakers, their subjects, and the dates at which they have appeared or will appear successively at the chapters in the order named above are:

Warner B. Bishop, Foundry Products Div. Archer-Daniels-Midland Co., Cleveland, *"Core Practice Control,"* September 14, 17, 19, 20 and 21; L. D. Pridmore, International Molding Machine Co., LaGrange Park, Ill., *"Technique of Core Blowing,"* and A.F.S. National Vice-President I. R. Wagner, *"Tools, Techniques and Taxes,"* both speaking at the Northwest Regional Foundry Conference, October 5 and 6; Ralph L. Lee, Grede Foundries, Inc., Milwaukee, *"Do You Know Your Costs?"* November 9, 12, 14, 15 and 16; William Romanoff, H. Kramer & Co., Chicago, *"Brass and Bronze Foundry Practice,"* January 11, 14, 16, 17 and 18.

Clyde A. Sanders, American Colloid Co., Chicago, *"Foundry Sands,"* January 8, 11, 13, 14 and 15; Hiram Brown, Solar Aircraft Corp., Des Moines, Iowa, *"Light Alloy Foundry Practice,"* or *"Non-Ferrous Core Sand Practice,"* March 14, 17, 19, 20 and 21; and Donald McCutcheon, Ford Motor Co., Dearborn, Mich., *"Non-Destructive Testing,"* April 11, 14, 16, 17 and 18.

Solicit Recommendations For Awards

RECOMMENDATIONS for 1952 A.F.S. Gold Medal and Honorary Life Membership awards are being solicited from the Board of Awards, and the chairmen of the Society's technical divisions and general interest committees. Deadline for receipt of recommendations is November 1. Statements supporting recommendations are expected to include explicit reasons for the recommendations and complete data on the men.

Meeting in December, the Board of Awards will select the men to be honored at the 1952 Convention.

GRAPHITE NODULES . . .

a note on spherulization of graphite in cast iron

F. H. Buttner, H. F. Taylor, and John Wulff*

A possible explanation of nodular graphite formation in cast iron is offered by the evaluation of interfacial energy between the liquid melt and the growing graphite particle. Equations are based on spherulitic growth and nucleation theories developed by other investigators, and the authors' work on surface energy.

One of the oldest and most persistent of metallurgists' dreams has been to make the graphite in cast iron precipitate or grow in nodular form rather than as flakes. At the 1948 Convention of the American Foundrymen's Society in Buffalo, N.Y., representatives of the B.C.I.R.A. in England[1] and of the International Nickel Co.[2] in America, introduced different methods for producing spherulitic graphite cast irons. The former used cerium to turn the trick and the Americans used magnesium. Since that time much speculation and some experimentation has been undertaken to explain the nucleation and growth of graphite flakes and nodules.

The following brief note is a possible explanation of nodule formation based on (1) Bernauer's spherulitic growth mechanism,[3] (2) the author's own work on interfacial energies of metals, and (3) the Becker Nucleation Theory[4]. From such analysis, it appears that the key lies in an evaluation of the interfacial energy between the liquid melt and the growing graphite particle, particularly in understanding the behavior of graphite surfaces as affected by foreign atoms.

The present authors find that high sulphur, commercial, gray cast iron (cf. Table 1) melted by induction in a pure graphite crucible, under helium,

TABLE 1—ANALYSIS OF SAMPLES REPORTED

	Composition, %				
	S	P	Si	Free Carbon	Combined Carbon
Commercial Gray Iron	0.099	0.23	2.41	3.44	0.38
Nodular Iron	0.016	0.040	2.84	3.90	0.19

wets the crucible; this is shown by the solidified plug, Fig. 1a. Remelted nodular iron (sulphur previously removed with magnesium) does not wet the graphite, as shown by the plug, Fig. 1b. Thus, the interfacial energy between melt and graphite is low in the case of gray iron, and high in remelted nodular iron.

Keverian[5] in this laboratory has obtained experimental evidence to show that graphite begins to precipitate, or nucleates in the melt. He finds that spherulites nucleate in proeutectic cast irons at temperatures below the liquidus but above the eutectic temperature. The particles nucleate in the liquid region preceding the advancing austenite dendrite front where local carbon concentrations reach hypereutectic proportions. The nodules finally are seen entrapped in transformed austenite at room temperature.

De Sy[6] finds that all cast irons except nodular irons supercool upon freezing. These observations are taken not only to indicate that nucleation originates in the melt, but also that in the case of nodular irons, artificial nuclei already exist in the cooling melt. Under the circumstance where the graphite originates in the melt, it is to be expected that the influence of high interfacial energy between the melt and graphite would be such as to favor the spherical form which is

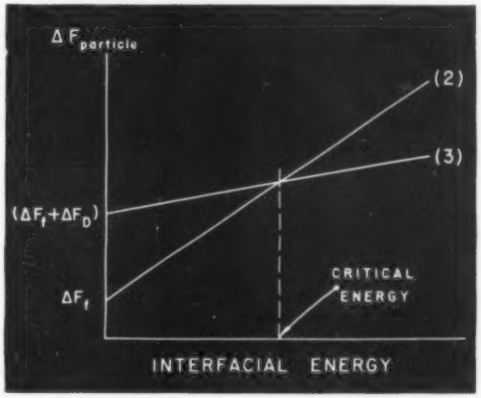


Fig. 1—Qualitative diagram showing relationship between a given volume of graphite as a flake (2) and as a sphere (3) vs. the interfacial energy between the graphite particle and the melt (Equations 2 and 3).

of lowest surface area for a given volume. In gray cast iron, interfacial energy is low and bears little influence on the shape of the particle which forms.

This suggests that apart from the energy stored in the surface of a particle, it is easier, or takes less energy, for the graphite to grow as a plate than as a sphere. Bernauer describes how spherulites may form in many different organic and inorganic media when an adsorbed film clings to the nucleus and inhibits the directional growth which normally leads to plates.

According to Bernauer, the film layer causes the particle to grow by means of the lowest energy basal plane interface first pushing forth in a front, and then flaring out to finally generate a spherical interface advancing into its liquid surroundings. By this means the basal planes become the skin of the spherulite, and the c-direction of the graphite crystal extends radially in all directions from the center of the sphere. By such a process, dislocations must be introduced

*Research Associate, Associate Professor of Metallurgy, and Professor of Metallurgy, respectively, Massachusetts Institute of Technology, Cambridge, Mass.

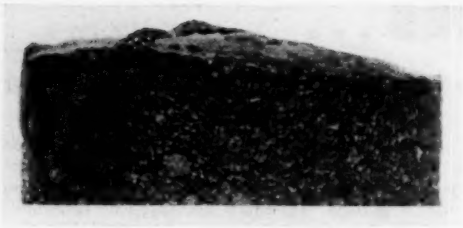
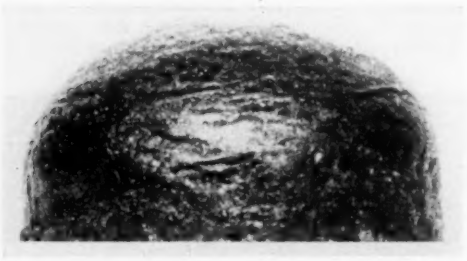


Fig. 1A—Crucible wetting occurs with gray cast iron melted in graphite tube, as shown by solidified plug.

Fig. 1B—Solidified plug of nodular graphite cast iron melted in graphite tube shows non-wetting of crucible.



into the crystal in order to maintain uniform atomic spacing in all the basal planes throughout the crystal.

These dislocations introduce added energy into the volume of the crystal. Thus, as far as volume energy alone is concerned, the plate form is of lower energy than the spherical form, and where interfacial energy is low, the particle will naturally assume the flake form. Bernauer also describes how local perturbations (at least in temperature and concerntration) of adsorbed elements in the immediate surroundings of the particle, may lead to the formation of oblong, branched, and other wierd structures as departures from the idealized sphere.

The above energy relations can be set down mathematically following the thermodynamics of the Becker[4] theory of nucleation. The Becker theory states that in a solution the beginning of precipitation occurs with an evolution of energy, $\triangle F$, where

$$\triangle F = \triangle F_v + \triangle F_{particle} \qquad (1)$$

$\triangle F_v$ is the molar free energy released by the reaction, and is by convention negative in sign. $\triangle F_{particle}$, a positive term, is the energy that returns to the system and resides in the particle itself. $\triangle F$ is the driving force of the reaction, and tends to become a maximum negative value, which means that $\triangle F_{particle}$ tends to become a minimum. When the shape of the particle is a flake,

$$\triangle F_{flake} = \triangle F_{formation} + \gamma_{l-g} A_{flake}, \qquad (2)$$

where $\triangle F_{formation}$ is the energy used in forming the volume of the flake, and is mainly $p \triangle V$, where p is the liquid head and $\triangle V$ is associated with the difference in density between the graphite and the melt. γ_{l-g} is the specific energy at the liquid-graphite interface, and A_{flake} is the area of the flake. In the case of the spherical particle, however, the right-hand member of the equation has an extra term to account for the added dislocations present in the spherical structure.

$$\triangle F_{sphere} = (\triangle F_f + \triangle F_{dislocation}) + \gamma_{l-g} A_{sphere} \qquad (3)$$

If a plot is made of Equations (2) and (3), as $\triangle F_{particle}$ vs. γ_{l-g}, the qualitative diagram of Fig. 1 appears. Equations (2) and (3) are at the moment linear, where the area in the last term is the slope of the line in each case, and the rest of the right-hand member of the equation is the vertical intercept. For a given volume in each case, the A_{flake} is a greater quantity than A_{sphere}; therefore, Equation (2) has a steeper slope. However, since the sphere has higher volume energy due to the added dislocations, Equation (3) has a greater vertical intercept. Plotted together, the two curves cross at a critical energy value, below which the flake form is the lower energy shape, and above which the spherical particle is the lower energy shape.

What does the inoculant (e.g., magnesium) do to gray cast iron to cause it to become nodular? To fit the above theory, its effect is threefold. First, it deoxidizes and desulphurizes. Supplementary experiments of the type mentioned above show that oxygen and sulphur added to pure Fe-Si-C alloys change the melt from non-wetting to wetting; so the removal of these elements from cast iron causes the interfacial energy between melt and graphite to increase above the critical energy value. Second, the inoculant in some way stimulates nucleation and graphite begins to grow in the melt. Third, the residual magnesium in the melt contributes to the absorbed layer of Bernauer, acting to cause the graphite nuclei to grow into spheres with the low energy basal generating the surface of the sphere.

It has seemed to the authors, after several years of surface energy research at the Metals Processing Laboratory at M.I.T.[7], that changing graphite flakes to spherulites was in some way an allied phenomenon. Bernauer's work seemed to supply the missing link. It is hoped this note will nucleate discussion of this interesting metallurgical development and the growth of our understanding will follow the Eyring rate theory.[8]

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Announce 1951's Top Winners of Ford INDUSTRIAL ARTS AWARDS for Patternmaking and Molding

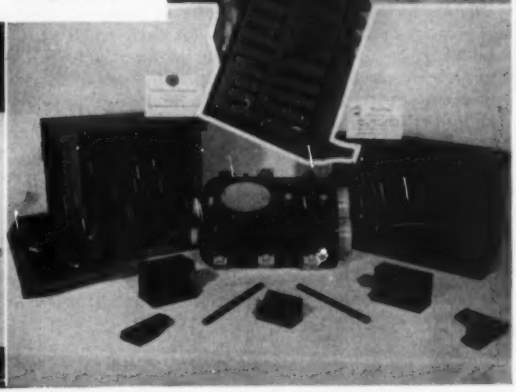


Winner of this year's Outstanding Achievement Award in the Molding and Patternmaking Division of Ford Motor Co.'s Annual Industrial Arts Awards contest is Robert Sloan of Cleveland's West Technical High School, whose rotor discharge casing pattern won out over hundreds of high school students' entries from all over the country. In addition to Mr. Sloan, who won a cash prize and a trip to Detroit for himself and Instructor William Beifuss, first prize winners are: Pattern, Henry Haller, West Technical High School, Cleveland; Molding, Robert Rosenberger and David M. Ciocci of Philadelphia's Murrel Dobbins Vocational Technical School; and Alan Kloskowski, Lane Technical High School, Chicago. Judging was at Chicago's Museum of Science & Industry.



Photos above show molding and patternmaking entries in Ford Motor Co.'s Industrial Arts Awards contest. Right: Alan Kloskowski displays his prize-winning fire place grate. Below left: Patternmaking and Molding Judges, from left: Thomas Diamond, School Shop magazine; R. C. Hitchcock, R. C. Hitchcock & Sons, Minneapolis; and H. A. Soztin, San Jose (Calif.) State College. Below right: rotor discharge casing that won Robert Sloan a Ford Outstanding Achievement Award—top honor in the molding and patternmaking division.





FOUNDRY SAND CONTROL

—No. 1 Enemy of Scrap

George W. Anselman
Superintendent
Beloit Foundry Co.
Beloit, Wis.

Poor foundry sand practice is responsible for 22 of the possible 31 defects that can occur in the casting of gray iron. Of these, 11 defects are directly attributable to sand—blows, hot tears and cracks, cuts and washes, erosion scabs, expansion scabs, drops, stickers and rats, metal penetration, fusion, swells, ram offs, and pin holes. Sand may be a contributing factor in a dozen other defects—scars, plates, hard or chilled spots, warped castings, misruns, cold shuts, inclusions, crushes, rough surfaces, core raises, runouts and bleeders—all are causes of scrapped castings.

THUS IT IS READILY APPARENT that proper sand control is perhaps the most important single factor in reducing foundry scrap, and it is the author's recommendation that any foundry running over 5 per cent scrap employ a full time sand control man and furnish him with adequate control equipment. Many foundries are reluctant to have an employee devote his full time to watching sand throughout the shop, following defective castings and pinning the trouble where it belongs, but the cost of scrapped castings far offsets that of sand control.

Since poor sand practice is directly responsible for 11 of the 31 known gray iron casting defects, this paper will tell how each of these defects can be overcome through sand control:

Blows. One of the principal causes of blows is excess moisture. Optimum moisture for each batch of sand depends upon the proportion of fines and the type of clay used, and is determined by testing for best permeability, green compression, and other physical properties. A curve of these properties is then plotted and a point established where best results are obtained on a combination of all properties. Then a tolerance of plus or minus 2/10 of 1 per cent for synthetic sands, and 1/2 of 1 per cent for natural sands is set up.

Synthetic sands require closer control than do naturally bonded sands, because a straight synthetic sand made with new sand and bentonite has a working tolerance of only 2.5 to 2.9 per cent moisture. Anything under this is too dry for proper ramming and working, and anything over produces blows in a mixture of lake sand, clay-free sand, and bentonite.

However, a synthetic sand combination of bentonite and fire clay has been found to work successfully with moisture content as high as 4 per cent. This mixture does not dry out as rapidly as other synthetic sands and is not too dry to patch and work after the pattern

(Top) Metal penetration, usually caused by soft ramming or too-high permeability. (Bottom) Severe penetration caused by soft ramming of core sand.



EDITOR'S NOTE: This paper was originally presented at the 1951 A.F.S. Wisconsin Regional Foundry Conference.

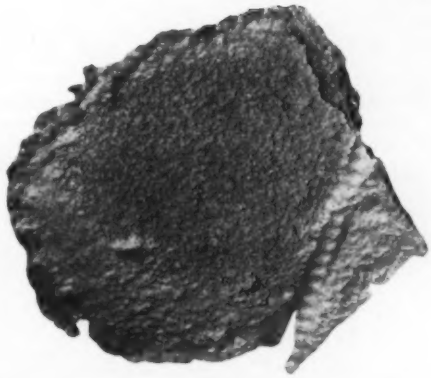
is drawn. Neither is it too wet to cause blows and pin holes in green sand work.

The permeability of the sand helps determine whether blows will occur. Sand should have at least 25 points of permeability for every inch of cross section of casting it is in contact with, up to about 100 permeability. Above 100, casting finish is inferior and metal penetration (discussed later) may occur. Permeability is an important control test which should be made regularly before the sand is used lest it be determined too late to be of any great value.

Iron in core vents is another chief cause of blows, but defects arising from this are often attributed unjustly to sand. To avoid this, cores should be carefully examined at the shakeout, to make sure that the vents are not plugged with iron. Cores should be vented, but at the same time the vents should be sealed so that iron cannot get in.

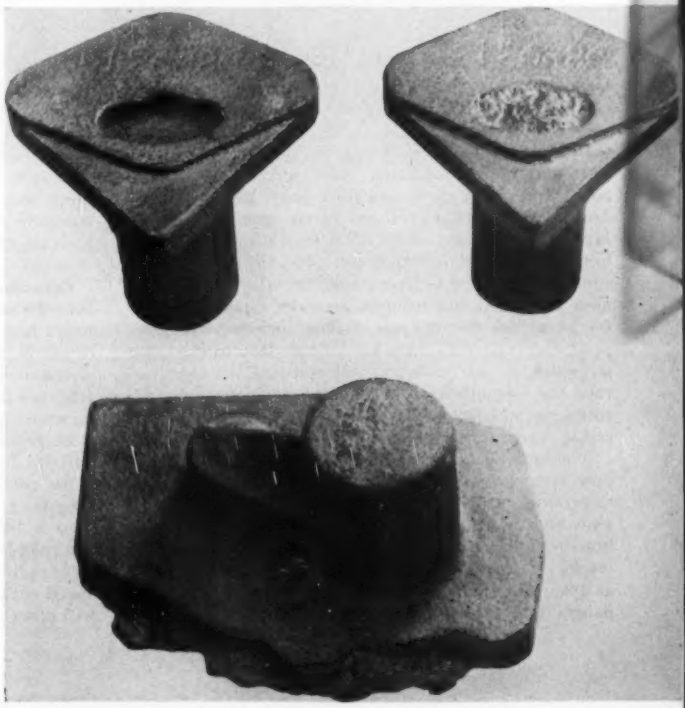
In bonding cores, it is important that not only room temperature characteristics but elevated temperatures be considered when making up a core sand mixture. Normally, elevated sand temperatures are about 100 to 200 degrees lower than actual pouring temperatures—roughly within a range of 2600 to 2750 F for light and medium gray iron castings. Temperatures above this at the cupola spout are considered excellent. By the time molten metal is poured into





Top and reverse-side views showing expansion scab caused by improper balance of sand and binders.

Two castings at top show stickers, while one at right below shows rats. Both defects are due to using sand with deformation less than 0.015 in. per in.



Blows in the casting below and in the one pictured in color on opposite page are due primarily to excessive moisture.



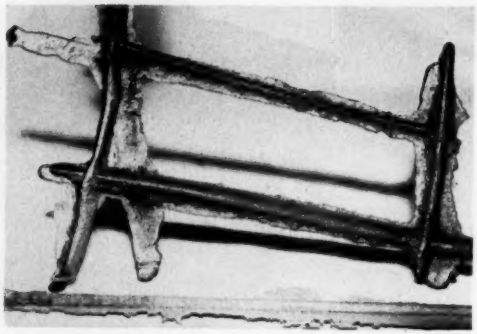
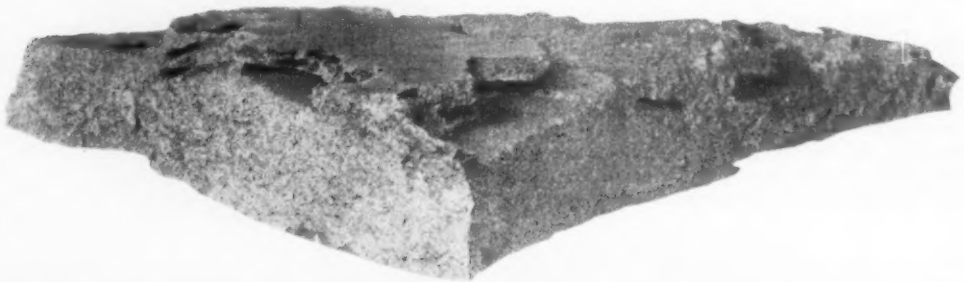


Photo shows iron that flowed into vents in a core, stopping gas flow and causing blows and blacking scabs. Fins are the result of molten metal flowing between core halves because vents were not stopped off correctly and cores were badly pasted.

Blacking scab caused by poor venting of cores.



the receiving or mixing ladle, then relayed to another ladle for pouring, at least 100 to 150 degrees are lost and the metal must be handled rapidly to avoid pouring below 2600 F.

Hot Tears and Cracks. Bonds in core sand mixtures burn out in the following order: oil, cereal, pitch, resin, iron oxide, clays, and silica flour. When an oil-bonded sand requires more green strength, cereal binders or clay are added, thus increasing the core's hot strength and lowering its collapsibility. If non-combustibles such as iron oxide, fire clay, and silica flour are added, hot strength increases rapidly, and if cracks are encountered one of these high hot strength producing materials must be deleted. Day to day observation in the foundry will indicate whether to raise hot strength because of cuts and washes on the cores, or whether to lower hot strength because of cracks where thin sections join heavy sections.

The same principle applies to molding sands. Here, however, mostly clays, pitch, and sea coal are used to produce extra hot strength. For any given clay content, high moisture gives high dry strength and high hot strength, which in excess are the main reason for cracks. Molding sand does not cause as many cracks as core sand, unless the casting has several lugs or flanges that restrain the casting during contraction, causing a hot tear or hot crack. Hot tears usually occur before complete solidification and produce marked discolorations in the casting, whereas if the crack is caused at lower temperatures, the break is cleaner and more metallic.

Cuts and Washes. These can be readily seen where erosion or cutting occurs in front of the gate and are usually due to soft ramming or lack of bond, particularly bond with insufficient dry or hot strength. Generally dry strength and hot strength are in proportion. For instance, a dry strength of 35 to 40 psi has a corresponding hot strength of 75 to 100 psi. When dry strength runs around 75 psi, hot strength is usually well over 200 psi.

Such gas producing materials as sea coal and pitch help produce greater hot strength and aid in stopping cuts and washes. Three major factors are responsible for cuts and washes. In order of importance these are sand, gating and risering, and molding. In trying to eliminate these defects, it is relatively simple to test the sand for dry and hot strength. If the sand tests well (somewhere between 40 and 75 psi should be adequate), gating and risering or ramming is at fault.

Erosion Scab. An erosion scab is caused by iron washing or boiling away a portion of the sand, leaving a scab or body of iron attached to the casting and depositing a mass of sand in some other part of the casting—usually on the cope side.

Erosion scabs may occur when the sand contains too much moisture, contains too much fine material, has too little permeability, or has too low a grain fineness with too wide a grain distribution. Insufficiently baked or green cores can also cause erosion scabs.

Expansion Scab. This is caused by improper balance between sand grains and binders. Sand grains expand under heat, while clay, seacoal, and pitch either shrink or soften, leaving room for the sand grains to expand. A common method of checking a sand for scabbing tendency is to make a standard specimen and put it in a furnace at about 2500 F. If it does not crack, the sand is balanced. If the sand is unbalanced, the specimen will develop large cracks and spall off on the surface.

An effective means of preventing expansion scabbing is to add some such material as cereal or wood flour to help cushion the sand grains and allow them to expand. When cereal or wood flour burn out they leave room for sand grain expansion, producing a balanced condition wherein clay and binder contraction will offset sand grain expansion.

Sand with a grain distribution confined largely to two or three screens requires wood flour or cereal to control expansion. A sand with wider grain distribution needs less of this material, or none at all. The author prefers the closely controlled sand plus cereal or wood flour method, because grain distribution is definitely known and clays can be added to take care of green, dry, and hot strengths.

Use of a four or five screen sand without cereal or wood flour works providing that screen analysis is carefully maintained with definite percentages on all of the screens. Because of the larger number of screens involved, the author believes the sand is much harder to control. It takes longer to change screen distribution than it does to add an additional ½ of 1 per cent cereal or wood flour to control expansion. If the differential in green compression strength is more than 2 psi between the facing and the backing sand, the facing will spall off, causing expansion trouble unless an excessive amount of facing is used.

Drops, Stickers and Rats. Green compression strength and deformation measurements readily determine whether sand is responsible for drops. If deformation is low, less than 0.015 in. per in., the sand is brittle and chips or breaks when the mold is closed, causing drops. This can be offset by adding western bentonite until deformation is increased to about 0.020 in. per in.

Sand low in deformation is also responsible for stickers and rats, and for chipping along edges of the casting. Again, deformation must be kept above 0.015 in. or more, but if deformation is too high the sand becomes sticky and gummy, has no flowability, and produces roughness and swells. Sand ranging in deformation from 0.015 to 0.020 is generally satisfactory.

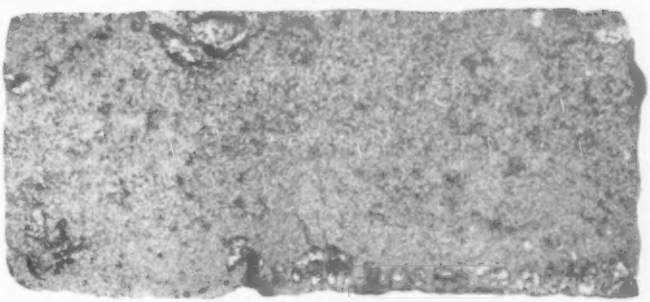
Metal Penetration. Soft ramming of sand, or too-high permeability, generally cause this defect. It is commonly believed that it is almost impossible to have too much permeability—but excessive permeability can cause penetration. An addition of 10 per cent silica flour will reduce permeability from 110 to 70, for example, and eliminate penetration.

A small addition of fines to a sand of closely controlled grain distribution drops penetration readily and closes the sand to a point where penetration stops. Most foundrymen have encountered small bolt hole cores through heavy sections of metal, for example from 6 to 14 in. counterweights, where cores are penetrated completely. In this case, a permeability of 20 to 30 is ample to take off gas and prevent blows from the cores. A good mix for this core is a sand on the 70, 100, 140 mesh screen, with about 25 per cent silica flour. If the sand is finer grained, say, on the 100, 140, 200 mesh screen, use from 5 to 10 per cent silica flour. This will produce a dry core permeability of 20 to 30 and will stop penetration.

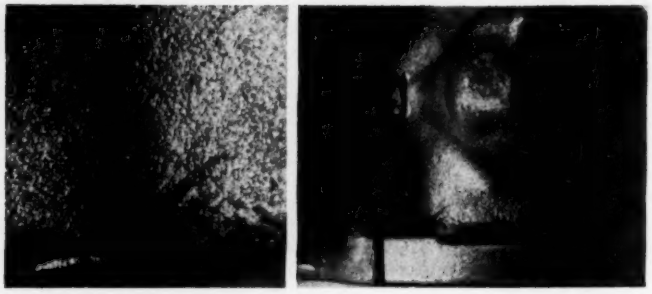
Soft ramming of core or molding sand causes high



Drops shown in top and bottom views of casting above, like stickers and rats, are caused by using sand with deformation of less than 0.015 inches per inch.



Pin holes shown at right are similar to blows, but differ in that they are caused by alien material that causes metal to boil.



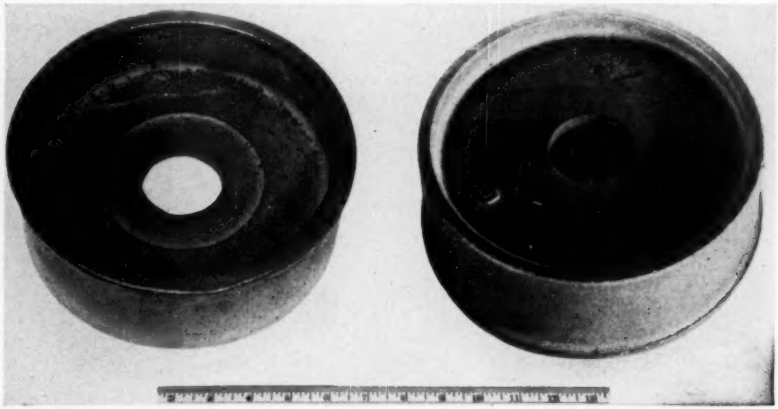
Cracked casting shown in detail (left) and overall view (right) was caused by addition of too much non-combustible material (iron oxide, fire clay, silica flour) to an oil-bonded core sand. Hot strength increased rapidly, lowering collapsibility and causing cracks. As in core sands, high moisture in molding sands can cause excessive dry and hot strengths, which in their turn can produce hot tears and cracks.

permeability and severe metal penetration, which is usually at its worst at the bottom of the casting and gets progressively less toward the cope. Too-high permeability combined with a high ferrostatic head, i.e., a deep mold and high permeability, is responsible for this. If cores are improperly pasted, metal is let in at the seam, producing a solid mass of metal and sand, particularly if the surface is not protected with blacking.

Penetration problems are heightened by an im-

fluxing material and will cause fusion. This simple field test is used by sand companies in checking new deposits.

Swells. Swollen and mis-shapen castings can be traced to sand that is too high in deformation. A sand with a deformation of more than 20 (0.020 in. per in.) is gummy, sticky, and hard to ram. Deformation can be reduced by adding sea coal, or by using a combination of clays, such as western and southern bentonite, or fire clay and southern bentonite.



Too much moisture or fine material in sand, or insufficiently baked green cores are causes of erosion scab.

proper mixture of large and small sand grains, which reduces flowability of the sand by preventing it from packing closely.

Fusion. This is caused by melting of sand, leaving a glassy surface of melted sand and bond that is almost impossible to chip or grind off the casting. Good sands have a pure, hard silica grain with a fusion point of about 3100 F. This sand, plus bonding clay, has enough hot strength to offset cuts and washes, but will not melt at pouring temperatures as high as 2750 F.

Fusion occasionally results from use of inadequately tested local sands containing such fluxing materials as fluorspar and lime. A simple test is made by pouring hydrochloric acid on the sand. If the sand boils readily, it should not be used because it contains a

Ramoff or Ramaway. This defect is sometimes mistaken for swells and is caused by a sand that is too low in flowability and too high in deformation. A ramoff occurs when the sand rams up against, or jolts against, the pattern and bounces away, leaving a gap between the pattern and sand. Close examination of the casting will indicate whether its defect is a swell or a ramoff. The ramoff follows the true shape of the pattern, except that it has moved a fraction of an inch away from its correct position. Elimination of ramoffs requires that deformation be brought down to approximately 0.020 to do away with sticky sand.

Pin Holes. Pin holes are often considered as blows, but they are really a separate defect, inasmuch as they differ in cause. Sand or any material that causes metal to boil, such as clay balls, rusty nails, or shot in the

sand will cause pin holes. These are small, pear-shaped gas holes not visible on the casting surface or, at their largest appear no larger than the point of a pin, whence they derive their name. However, when the casting is machined, the hole enlarges. The hole is always close to the surface if it is a true pin hole.

A wet cupola spout, ladle lining, or lip will cause enough metal boil to produce pin holes on light section castings, but not in heavier sections unless the metal is exceptionally cold when it is poured. The slower rate of solidification of heavy sections permits gas to escape without forming holes under the surface.

Although pin holes are principally due to sand, inclusion of non-ferrous metals such as lead, tin, antimony, or aluminum in scrap may cause these defects. When an epidemic of pin holes occurs in light section work, metal should be checked thoroughly before blaming sand for the defects.

As previously mentioned, sand may be a contributing factor in producing scars, plates, hard or chilled spots, warped castings, misruns, cold shots, inclusions, crushes, rough surfaces, core raises, runouts, and bleeders.

Sand causes these defects only when its faults are combined with molding mistakes or with faulty pouring, equipment, or metal composition. These combinations must be studied and remedied individually. If rigid sand controls are applied in the foundry, 23 out of the 31 gray iron casting defects will be overcome and reduction in scrapped castings alone will more than pay for the time, money, and effort spent on adequate sand control.

LETTERS TO THE EDITOR

Acid vs. Basic Refining

In the September issue of AMERICAN FOUNDRYMAN, A. H. Thomson makes the following statement on page 52 in his article *"Basic Refractories and Slags for Electric Steel Furnaces"*—*"Use of basic refractories and basic slags in electric furnace steel melting permits the use of unselected scrap, since the basic furnace also refines the metal, in contrast to the acid electric furnace which does little more than melt the charge."*

It is most unfortunate that a statement such as this is published in any magazine, particularly *"The Foundrymen's OWN Magazine."* The statement is totally and completely false. We have no criticism of basic practice as it has certain advantages as well as disadvantages in the production of steel for castings. We do, however, want to make it clear that the acid electric methods of steel production in use today are as much refining in their actions as are the basic electric methods of steel production. If there is any question in anyone's mind as to the truth of this, all he need do is survey the steel foundries in the United States and Canada and see how many are melting acid and also note the fine quality of steel produced in most of these foundries.

Admittedly the rising sulfur content of scrap is becoming more of a problem every year and basic practice can reduce the sulfur. There are, however, a number of investigations going on today to reduce sulfur in steel produced by the acid process. The early results are encouraging.

We hope Mr. Thomson will acquaint himself with the refining methods used in the production of acid electric steel and will issue a correction to his statement in the September issue of AMERICAN FOUNDRYMAN.

H. H. BLOSJO, *Metallurgist*
Minneapolis Electric Steel Castings Co.
Minneapolis

Mr. Thomson's original statement, condensed in editing, included the words *"the furnace does considerably more real refining than does the acid electric furnace which does little more . . ."* Possibly this can be resolved by determining Mr. Blosjo's and Mr. Thomson's interpretations of "refining" or "real refining". Any other steel men want to settle this?
—EDITOR.

High Production Aids

We were pleased to find A. J. Howarth's *"Gating Principles Applied to Gray Iron Casting Produced on Matchplates"* in the July issue of AMERICAN FOUNDRYMAN. His ideas can be put to good use in our foundry, where we installed a mechanized sand handling system three years ago. In Fig. 1, Mr. Howarth shows castings made in a 11 x 18-in. flask with a 4-in. drag and a 5-in. cope at the rate of 450 per 8-hr. day. Is this done by one man or by two men each on a separate cope or drag?

J. S. WEEKS, *Vice-Pres.*
Independence Stove & Furnace Co.
Independence, Mo.

Howarth Tells How

The production was by one man working on a single jolt-squeeze machine using a pop-off flask. While the work day was eight hours, actual production time was only 7-½ hours. Sand was distributed to the molders' hoppers from a central mixing point by overhead belt. Hoppers were the clam shell type and air operated.

Several other castings described in the article were produced in the same manner and a peak production of 685 molds was made by one operator in an 8-hr. day with the usual time allowances for personal reasons. A number of foundries with mechanized systems are capable of producing molds in these quantities. Synthetic sand is necessary so that more accurate control of specifications can be maintained. Sand used and specifications required would depend on casting requirements and local sand supply.

The article was to deal only with gating problems and the mention of the number of molds produced was only incidental. The arrangement of the gates to produce good castings is only one of the requirements for high production of this work.

Your letter leads me to believe that you enjoyed the article in our magazine. Later there may be an article on production of matchplate castings which will deal with sand control, types of sand and additives and other production factors.

A. J. HOWARTH

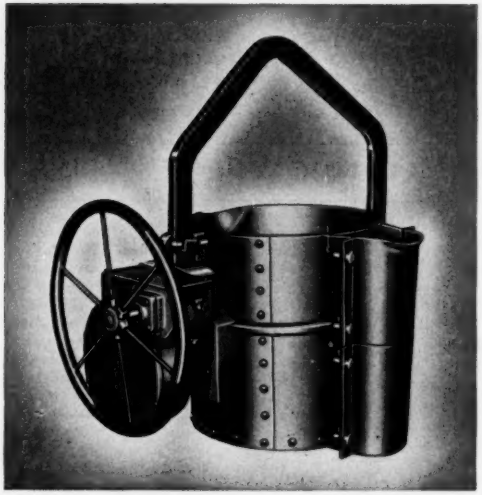
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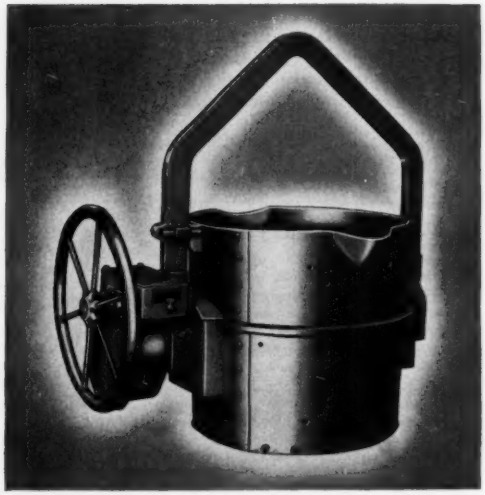


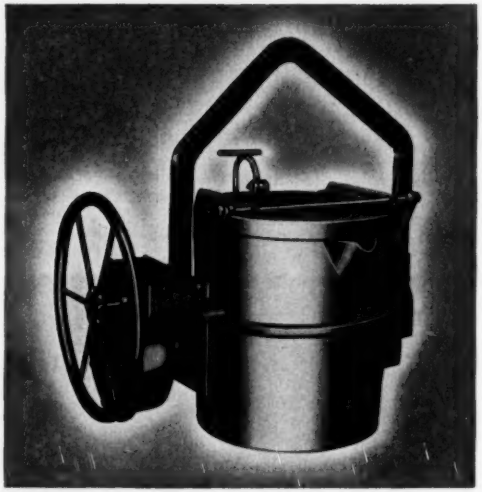
The casting discussed in Messrs. Weeks and Howarth's letters. Photograph originally appeared as Fig. 1 in Mr. Howarth's article, "Gating Principles Applied to Gray Iron Castings Produced on Matchplates," appearing in the July, 1951, issue.

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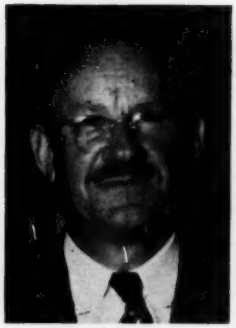
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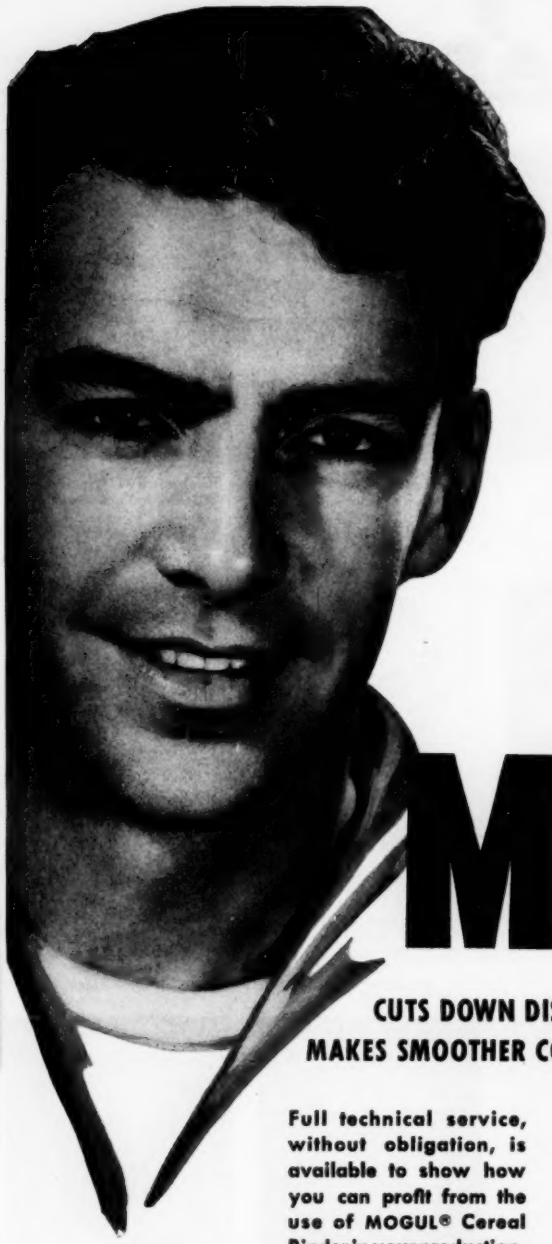
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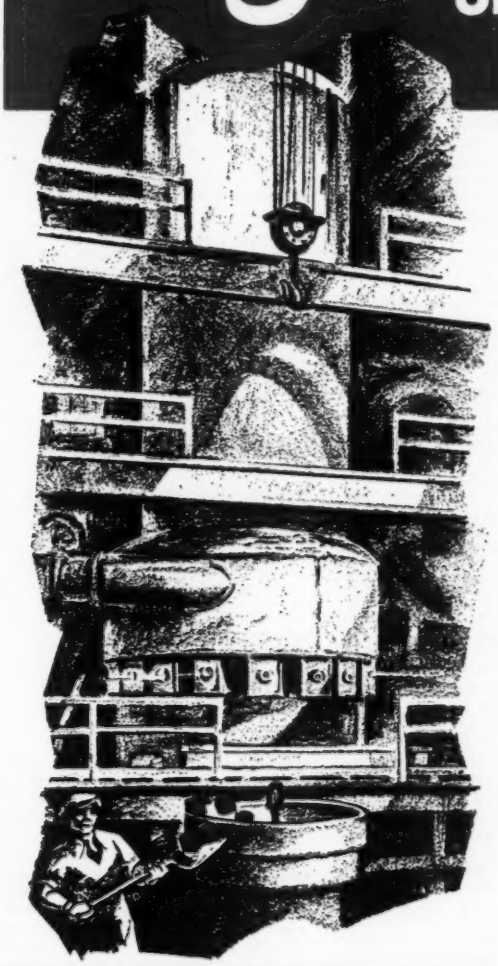
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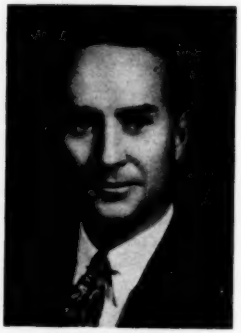
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FOUNDRY *Activities*

Dr. James T. MacKenzie, A.F.S. National Director and technical director, American Cast Iron Pipe Co.; **Oliver Smalley,** president, Meehanite Metal Corp., New Rochelle, N. Y.; and **D. Sharpe** of Glasgow, Scotland, a past president of IBF, were elected Honorary Life Members of the Institute of British Foundrymen at its Annual Meeting, held at Newcastle-upon-Tyne, England.

Eads Johnson, Jr., has been named executive vice-president of American Brake Shoe Co.'s Southern Wheel Division. Mr. Johnson, who started with Brake Shoe in 1934 after graduation from Yale Univer-



Eads Johnson, Jr.

sity, was first in sales work for the Brake Shoe & Castings Division, then transferred to Southern Wheel in 1949, where he was assistant vice-president at the time of his new appointment. Mr. Johnson saw five years service with the Navy in World War II, coming out as a Lieutenant Commander.

W. Cordes Snyder, Jr., of Sewickley, Pa., has been elected president and chief executive officer of Blaw-Knox Co., Pittsburgh. Mr. Snyder previously was a vice-president of the company in charge of its Lewis Foundry & Machine Division, and more recently was vice-president and manager of the metallurgical department of the Koppers Co. He will assume his new duties on or about November 1. **William P. Witherow** will continue as chairman of the board, and **Chester H. Lehman** will continue as executive vice-president and board vice-chairman.

Herbert F. Miller has been appointed general superintendent of Marion Malleable Iron Works, Marion, Ind., a subsidiary of Chicago Railway Equipment Co. Also named is **Albert E. Salatka,** to be works manager. Mr. Miller, holder of an M. E. from Harvard University, has been a consulting engineer and superintendent of gray iron, malleable and steel foundries, and during the war was consulting foundry engineer to the Canadian Department of Munitions and Supply and superintendent of Continental Foundry & Machine Co.'s Defense Plant Foundry. Mr. Salatka has been with Chicago Railway Equipment Co. and its subsidiaries since 1929, and since 1948 has been general superintendent of the Marion Malleable Iron Works.

Clarence H. Lorig, assistant director, Battelle Memorial Institute, Columbus, Ohio, recently received a Distinguished Service Citation from the University of Wisconsin for his accomplishments in the field of metallurgical engineering. Dr. Lorig last year was awarded the A.F.S. Joseph S. Seaman Gold Medal for his work in metallurgical research.

Edward W. Beach, retired foundry executive of Muskegon, Mich., recently won a certificate of merit from the Photographic Society of America for his documentary film on Nantucket, Mass., "The Little Gray Lady of the Sea." Mr. and Mrs. Beach wrote the script and filmed and recorded the documentary in sound and color, using up their summer vacations for four years to get some 3,200 feet of film, which they pruned to 1,000 feet in the finished prize-winning production. The award was the culmination of 65 years of photography for Mr. Beach, who built his own leather-bellows camera at the age of 12, and who has filmed many scenes in remote corners of the earth, as well as in the foundry and other industries. The Photographic Society award was the second honor accorded Mr. Beach in the past year. The first was presentation of Honorary Life Membership in the American Foundrymen's Society at the 1951 Convention "for outstanding contributions to the Society and the castings industry in foundry engineering." Prior to his retirement, Mr. Beach was for 23 years an engineering executive of Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

Martin Dietl has been named foundry production engineer for the Schaible Co., Cincinnati, where he will be responsible for non-ferrous foundry plant and production engineering, and for plant layout, space analysis, production quality and equipment, costs and maintenance. Mr. Dietl was formerly metallurgical melting foreman at Crane Co.'s brass and bronze foundry, Chicago.

Frederick L. Murray, since 1943 iron, steel and large core molding foreman at Hunt-Spiller Mfg. Corp., Boston, has been named assistant superintendent of foundries. Mr. Murray joined Hunt-Spiller in 1919 as a carpenter's helper. He succeeds **William E. Mulcahy,** newly named superintendent of foundries.

Walter W. Edens, formerly assistant Castings Potential Projects director for Alloy Engineering & Casting Co., Champaign, Ill., has been named Defense Projects Executive, and **Thomas G. McNamara,** formerly chief metallurgist for Continental Aviation & Engineering Corp., Detroit, has



T. G. McNamara

been appointed chief metallurgist. Both Mr. Edens and Mr. McNamara will be active in carrying out special castings research assignments for the Armed Forces.

Howard E. Voit has been named to succeed **George H. Lambkin,** who retired after 30 years as New York office branch manager for Sterling Wheelbarrow Co. Graduated from the University of Wisconsin in 1942, Mr. Voit attended Columbia University's Navy Midshipman School that same year and later saw duty as an ensign in both the Atlantic and Pacific Theaters. He joined Sterling's Milwaukee sales department in 1946 and was subsequently transferred to the New York office. Mr. Voit is a director and membership chairman of the A.F.S. Metropolitan Chapter.

G. R. Fitterer, professor and head of the University of Pittsburgh's department of metallurgical engineering since 1939, has been named dean of the Schools of Engineering and Mines. Holder of a B. S. in metallurgical engineering from Rose Polytechnic Institute in 1924, an M. S. in metallurgy from Carnegie Institute of Technology in 1927 and a Ph. D. from the

University of Pittsburgh. Dr. Fitterer has been with the University of Pittsburgh since 1931, except for a brief leave of absence to organize the Fitterer Pyrometer Co. in 1934. Dr. Fitterer has been cited by the Navy for training 2200 inspectors during the war, and carrying out steel research for the Navy. In 1944, he was named ASM's Campbell Lecturer.

Harry W. Jobes is the new general manager of United States Radiator Corp.'s Metal Products Division plant at Chicago Heights, Ill. An Army Major in World War II, Mr. Jobes was in command of a Regional Procurement Office supervising contractual obligations and expedited military contracts in some 300 plants.

Dr. H. K. Ihrig, formerly with Globe Steel Tubes Co., and newly named vice-president in charge of research for Allis-Chalmers Mfg. Co., Milwaukee, announces the appointment of **Arthur K. Higgins,** formerly foundry superintendent, as assistant director of research. Mr. Higgins will supervise chemical and metallurgical investigations, trouble-shooting and control. He is chairman of the A.F.S. Brass & Bronze Division and a member of the Society's Technical Correlation Committee.

James F. Eversole has been appointed manager of research administration of Union Carbide & Carbon Corp. A member of that organization since 1929. Dr. Eversole will help coordinate research activities of all of UCC's laboratories.

Robert Wright has been named purchasing agent and assistant to Director of Purchases **F. H. Stillman; William Donner** has been promoted to assistant buyer; **Paul Anderson** to buyer of finished products; and **Frederick Bradford** joins the Watson-Stillman Co., Roselle, N. J., as rough materials buyer, succeeding **John Feehan,** who resigned recently.

Richard A. Flinn, A.F.S. Simpson Gold Medalist and assistant chief metallurgist in American Brake Shoe Co.'s Research and Development Center, has accepted an associate professorship of product engineering and metallurgical engineering at the University of Michigan, where he will be in charge of the University's Experimental Foundry. Mr. Flinn will retain connections with Brake Shoe as a consultant.

William A. Spence, formerly field engineer, has been appointed general manager of the Ohio Hoist & Mfg. Co., Cleveland, and will supervise manufacture and sales distribution of the company's line of materials handling equipment.

Lucio F. Mondolfo, associate professor of metallurgical engineering, Illinois Institute of Technology, Chicago, has been promoted to professor. Dr. Mondolfo received his D. Sc. from the R. Polytacnic, Milan, Italy, where he served as a research metallurgist before coming to this country in 1937 to join Illinois Tech. Dr. Mondolfo was co-author of a paper on metallurgy presented at the 1951 A.F.S. Convention.

A. F. S. CHAPTER DIRECTORY

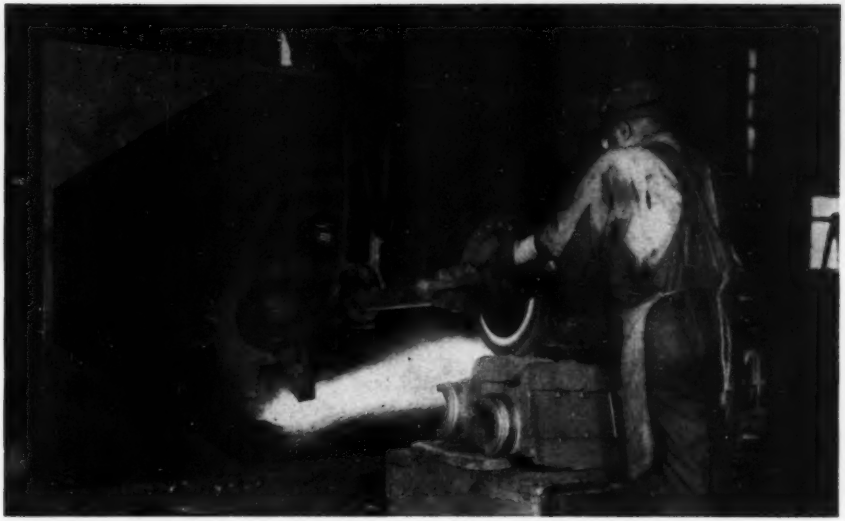
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WISCONSIN CHAPTER *Secretary,* Albert F. Pfeiffer, 1610 S. 78th St., West Allis 14, Wis.

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PENN STATE COLLEGE *Secretary,* Ronald Altobelli


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Horseshoe artist puts body English into his toss as a gallery of barnyard superintendents watch critically at Chicago Chapter's Outing. Photo courtesy of Irv Dennen, Beardsley & Piper Div., Pettibone Mulliken.

CHAPTER ACTIVITIES NEWS

Birmingham District

J. P. McClendon
Stockham Valves & Fittings, Inc.
Chapter Reporter

ANTICIPATING more than 500 foundrymen and their guests, the chapter's Entertainment Committee held a meeting to plan the chapter's Eighteenth Annual Barbecue, scheduled for Saturday, September 15, at Cascade Plunge.

As planned, the menu included barbecued chicken and ribs, potato salad, slaw, pickles, sliced tomatoes, buns, iced tea, lemonade and ice cream. Sports events scheduled were horseshoe pitching, softball and exhibition boxing matches.

Entertainment Committee consists of Elliott M. Cranford, Stockham Valves & Fittings, Inc., chairman; Joe T. Gilbert, also of Stockham Valves, co-chairman; Grover C. Arnwine, Alabama By-Products Corp.; William Bach, Foundry Service Co.; T. H. Benners, T. H. Benners & Co.; Ernest C. Finch and Gene Whelchel, American Cast Iron Pipe Co.; Henry Guthrie, DeBardeleben Coal Corp.; Morris L. Hawkins, Stockham Valves & Fittings, Inc.; Ben Spann, National Cast Iron Pipe Co.; and Fred C. Barbour, McWane Cast Iron Pipe Co., who will serve as sergeant-at-arms.

A special invitation was extended to officers of the Tennessee Chapter to attend the Barbecue.

Southern California

Alfred A. Grant
Grant & Company
Publicity Chairman

FOURTEENTH ANNUAL Summer Outing of the Southern California Chapter was held at the Lakewood Country Club, Long Beach, on August 11.

Activities lasted from morning through evening, with golf, baseball, horseshoes and a barbecue to occupy 380 members and their guests during the day. An excellent dinner was served, followed by a program of professional entertainment.

Success of this Outing is attributable to efforts of the Entertainment Committee, headed by William C. Baud of Mechanical Foundries Div., Food Machinery Corporation.

First meeting of the 1951-52 season



A foundry foursome holing out on the ninth at Canton District Chapter's Annual Picnic, held August 18 at the Mayfair Country Club, near Canton.

was held September 14 at Rodger Young Auditorium, Los Angeles. Featured speaker was Warner B. Bishop, the Archer-Daniels-Midland Co., Foundry Products Div., Cleveland, whose subject was *"Foundry Core Binder Characteristics and Use."*

Supplementing Mr. Bishop's talk was a motion picture, *"The ADM of Cores"*. This film comprised a study of core room control and techniques, and explained various causes of core failures. Among these were results of too-much or too-little use of core binders, as well as effects of using different types of sands.

Emphasized in the film was the importance of oil and sand control, and the need for careful inspection of cores to ascertain troubles or defects in advance, so that future core runs do the job they are designed to do.

Following this, Mr. Bishop held a question-and-answer period, in which many of the 112 foundrymen in attendance participated.

Canton District

William T. Cole
Canton Malleable Iron Co.
Chapter Reporter

ANNUAL PICNIC, held at the Mayfair Country Club, Canton, August 18, was attended by 125 members and guests of the chapter.

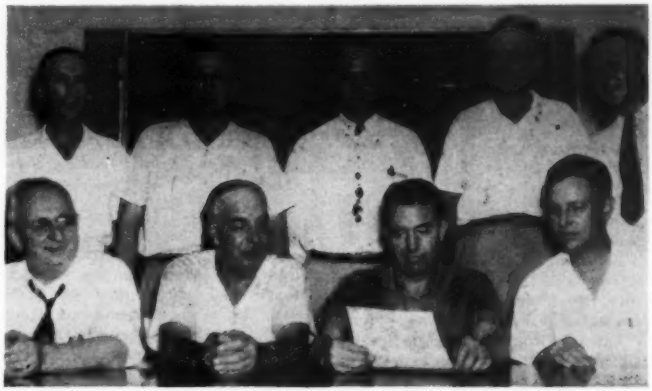
Golf and a roast beef dinner were among the day's highlights. Winners of the golf tournament were:

Low gross—Myron Boyd, Massillon Steel Castings Co., Massillon. Long drive on the first hole—Charles Stroup, American Steel Foundry Co., Alliance. Long drive on the 18th hole—Albert Phipps, Mexico Refractories Co., Canton.

(Continued on Next Page)



H. G. Schlichter, Beardsley & Piper Div., Pettibone Mulliken Corp.; Robert Jones and Harry Cullen, United States Steel Corp., were sparkplugs of Chicago Chapter's Annual Outing, Lincolnshire Country Club, August 18. Photo courtesy Chapter Director W. D. McMillan, International Harvester.



Meeting recently at Stockham Valves & Fittings, Inc., Birmingham, to plan Birmingham District Chapter's Annual Barbecue were, standing, left to right: Entertainment Committee Members William K. Bach, Gene Whelchel, Henry Guthrie, Ben Spann and Chapter Secretary-Treasurer John Drenning. Seated from left are Chapter Vice-Chairman Fred K. Brown, Chapter Entertainment Committee Co-Chairmen J. T. Gilbert and E. M. Cranford, and Birmingham District Chapter Chairman Charles K. Donoho.

Games of skill of all kinds were featured attractions on the day's program as Canton District Chapter met for its Annual Picnic at the Mayfair Country Club on the outskirts of Canton on August 18.





Headliners at Central Michigan Chapter's opening meeting of the 1951-52 season, held September 19, were, left to right: Technical Chairman Walter B. Millar, Battle Creek Foundry Co.; Chapter Chairman T. T. Lloyd, Albion Malleable Iron Co., and Speaker William T. Bean, Jr., consultant.

Wisconsin

Albert F. Pfeiffer
Allis-Chalmers Mfg. Co.
Chapter Secretary

FIRST MEETING of 1951-52 was held in the Crystal Ballroom of the Hotel Schroeder, Milwaukee, September 14.

Following dinner and a film on *"America in Crisis,"* members split up into their respective interest groups for sectional meetings.

Pattern Group had as its speaker Cliff W. Schwenn, Brillion Iron Works, Brillion, who led discussion on *"Pattern Rigging in Cooperation with the Foundry."* Co-chairmen were Walter Kollmorgen, Kollmorgen Pattern Works, and M. C. Frankhard, Delta Mfg. Div., Rockwell Mfg. Co.

Gray Iron Group speaker was W. G. Reichert, W. G. Reichert Engineering Co., Newark, N. J., whose topic was *"Foundry Management Looks Ahead with Pushbutton Control."* Chairmen were D. R. Hutchinson, Nash Motors Div., Nash-Kelvinator Corp., and Leo Koening, J. I. Case Co.

Under the co-chairmanship of Erwin G. Tetzlaff, Pelton Steel Casting Co., and Harold Ziebell, Crucible Steel Casting Co., the Steel Group heard Clyde A. Sanders, American Colloid Co., Chicago, speak on *"How Can Molding Materials and Their Use Affect Metal Shrinkage?"*

Malleable Group speaker was B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., who discussed *"Malleable Gating Practice."* Co-chairmen were Norman E. Amrhein, Federal Malleable Co., and Ralph Schaper, Wisconsin Appleton Co.

Non-Ferrous Group, headed by Co-Chairmen G. R. Funk, Waukesha Foundry Co., and K. L. Jacobs, Standard Brass Works, heard Joseph A. Gitzen, Delta Oil Products Co., Milwaukee, speak on *"Aspirin for Core Room Headaches."*

Quad City

FIRST MEETING of the season had as its speaker Clyde A Sanders, American Colloid Co., Chicago. The meeting was held at the Fort Armstrong Hotel, Rock Island, Ill., September 17.

More than 125 interested foundrymen were present to hear Mr. Sanders' excellent discussion of *"The Effect of Mold Materials on Apparent Metal Shrinkage."* The speaker explained how various additives to molding sands can cause deformation of the mold, and in turn produce apparent metal shrinkage. An interesting discussion period followed his presentation, and continued long after adjournment of the meeting.

George Golson of the Moline *Dispatch* presented the coffee talk, and showed colored slides of his recent trip up the Alcan Highway to Fairbanks, Alaska.

N. Illinois—S. Wisconsin

J. S. Zabel
Zabel Foundry Sales, Inc.
Chapter Reporter

OPENING THE 1951-1952 SEASON was a dinner and technical meeting September 10 at the Bel-Mar Country Club, Belvidere, Ill. Chapter Chairman Carl Dahlquist, Greenlee Brothers & Co., Rockford, Ill., presided.

In the afternoon, some members enjoyed a game of golf while others visited an open house at the foundry of the National Sewing Machine Co., Belvidere.

Speaker for the technical program was George Anselman, Beloit Foundry Co., who used slides to illustrate his talk on *"Casting Defects."*

The speaker pointed out the necessity for good sand and melting practices to minimize scrap, and stressed the importance of laboratory sand control and clean scrap in the cupola.

Timberline

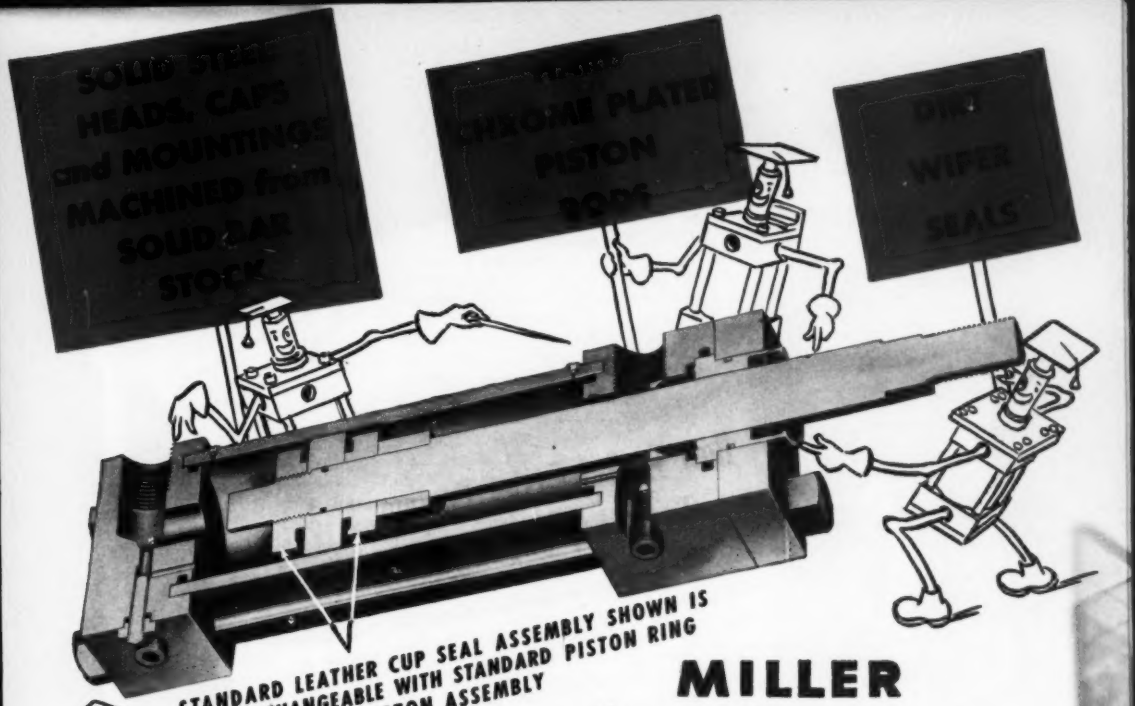
Harold Simmons
Electron Foundry
Publicity Chairman

INITIAL MEETING of the year was held Monday, September 10, at the Oxford Hotel, Denver. Of the chapter's

(Continued on Page 75)



Chow and chatter followed a full day of golf, horseshoes, baseball and recreation at the Chicago Chapter Outing at Lincolnshire Country Club. Photo courtesy Irv Dennen, Beardsley & Piper Div., Pettibone Mulliken.



STANDARD LEATHER CUP SEAL ASSEMBLY SHOWN IS INTERCHANGEABLE WITH STANDARD PISTON RING PISTON ASSEMBLY

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An application of colloidal graphite will produce an unusually slippery dry film because of its peculiar arrangement of atoms. It is virtually unaffected by heat . . . . up to 5000° F. in inert atmospheres . . . and is so thin that critical casting tolerances are not affected at all.

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"Dag" water dispersions also eliminate or reduce the choking fumes and smoke usually caused by conventional petroleum-base parting compounds, thus improving shop conditions.

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Core Hardness



Every foundryman knows that the relative hardness condition of cores tells its tale in the casting. All the advantages of accurate core-hardness control can be obtained with this direct-reading, Gordon-Campbell Core Hardness Tester. The test results are dependable — and obtained easily in a few seconds. No special skill is required.

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OTHER Gordon & Campbell TESTING EQUIPMENT:

Combination Rammer-Compression Tester—Simple way to prepare specimens to determine compression strength.
Permtester—A foolproof method for determining sand permeability.
Transverse Test Core Maker—For preparing core specimens for transverse tests.
Transverse Core Tester—Rapidly determines transverse strength of dry sand cores.
Baking Oven—Electrically heated, dries sand samples, bakes core specimens.
Moisture Tester—A reliable method of measuring moisture content.
Sand Mixer—For thorough preparation of sample core-sand mixtures.
Sand Washer—The easy-to-use method to determine clay content of sand.

Each of these testing units was designed to conform with the recommendations of the Committee on Foundry Sand Research of the American Foundrymen's Society.

Complete information upon request.

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CHAPTER ACTIVITIES

(Continued from Page 72)

total membership of 63, 48 were in attendance. It is interesting to note that Timberline Chapter comprises the largest territory of any chapter in the United States or Canada, and at the same time, perhaps the fewest number of foundries.

Speaker of the evening was M. W. Demmler, Harbison-Walker Refractories Co., who presented an excellent well-received talk on *"New Applications of Refractories as an Aid to the Foundry."* His discussion was subdivided into three sections:

(1) Properties and uses of various molding materials, other than sand. This section dealt with the work of the SFSA Research Project 22 in developing new molding materials, many of which should find extensive application in foundries.

(2) Acid electric furnace linings. A discussion of refractories used in various parts of an electric furnace, particularly roof linings.

(3) Basic cupolas. History and development of basic cupola practice, which in recent years has become increasingly popular because of its adaptability to new engineering irons.

Judging from the enthusiasm with which the kickoff meeting was received, the Timberline Chapter anticipates a banner year.

St. Louis District

James F. Gilbert
J. F. Gilbert Co., Inc.
Publicity Chairman

FIRST MEETING of the new season, held September 13, featured an interesting and instructive talk on *"Foundry Core Binders; Their Characteristics and Use,"* by Warner B. Bishop, Foundry-Products Div., Archer-Daniels-Midland Co., Cleveland, presented before an attentive audience of 120 members and their guests.

Chairman Ralph M. Hill, East St. Louis Castings Co., presided and introduced new Directors and Committee Chairmen.

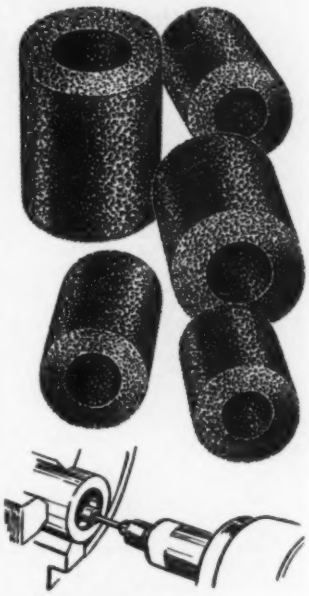
Henry W. Meyer General Steel Castings Co., Chapter vice-chairman and chairman of the Program Committee, gave a brief resumé of speakers and activities for the new season.

A.F.S National Director A. L. Hunt, National Bearing Div., American Brake Shoe Co., gave a glowing report on the chapter's activities at the Missouri School of Mines, Rolla. He stated that the school now has a complete foundry to enable students to gain practical experience, and said that at least 50 men from the school have obtained positions in the foundry industry this past summer. At least six past-grad-

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uates have worked themselves up to responsible positions in the St. Louis area, he added.

Membership Committee Chairman, Walter A. Zeis, Walter A. Zeis Co., said the chapter now has 258 members and expects to have 270 in the near future.

Mr. Bishop was introduced by Technical Chairman N. L. Peukert, Carondelet Foundry Co. Mr. Bishop's talk was well presented and he said that the best core is the cheapest core that will do the job, because it is an expendable item, only used once.

Mr. Bishop emphasized that all ingredients in cores should be measured by weight and never by volume, because volume measures have a bad habit of getting out of shape and thus hold less than they did originally.

The speaker said that because sand makes up the largest percentage of ingredients in any core, foundrymen should know what a particular sand consists of, and if the sand changes in grain size, clay content, moisture or impurities, core mixes can be changed before they result in scrap castings.

If any of these elements change, he added, other ingredients in the mix must be changed to insure good cores.

Following his talk, Mr. Bishop showed a color, sound motion picture, *"The A.D.M. of Cores,"* which stressed the importance of controlling sand, binders, moisture, baking time and temperature to obtain good cores. These, he concluded, mean salable castings in the shipping department. The picture was followed by a question and answer period.

Central Michigan

J. T. Ehman
Albion Malleable Iron Co.
Publicity Chairman

FIRST MONTHLY dinner meeting of the 1951-52 season was attended by 60 members and guests at the Hart Hotel, Battle Creek, September 19.

A welcome was extended to the members and guests by Chairman T. T. Lloyd, Albion Malleable Iron Co., who followed this with a brief summary of the background and functions of the American Foundrymen's Society. Plans for the coming year were reviewed by Mr. Lloyd, and an invitation was then extended to the chapter members by Professor A. J. Smith, Department of Metallurgical Engineering, Michigan State College, to attend the regional conference at East Lansing on October 11 & 12, 1951.

Mr. Lloyd then introduced as technical chairman of the evening Walter B. Millar, Battle Creek Foundry Co., who in turn introduced William T. Bean, Jr., speaker of the evening. Mr. Bean spoke on *"Sound Castings CAN*

be Engineered". His fresh approach to the age-old problems of casting design made his lecture entertaining and instructive to all branches of the industry represented at the meeting. A clear and logical approach to the problem of stress analysis by the use of electronic strain gauges proved informative.

Lafayette College Holds Second Foundry Meet

HOWARD F. TAYLOR, associate professor of metallurgy, Massachusetts Institute of Technology, was featured speaker at the second foundry meeting held by Lafayette College, early this summer.

Some 200 foundry students and faculty members heard Professor Taylor discuss fundamental foundry sand and clay practices and explain the relationships between the practical and scientific approaches to foundry sand problems. President Hutchison of Lafayette College, who originated the college's annual technical seminars last year, opened the meeting. Technical Chairman for the event was Howard Williams, New Jersey Silica Sand Co.

Dietert Sand School Draws 135 Foundrymen

FOURTEEN STATES AND CANADA were represented at the Sand School conducted by Frank S. Brewster of the Harry W. Dietert Co. in Detroit, August 20 through 23.

Ohio was represented by 34 foundrymen; Michigan by 32; and Illinois and New York were tied for third in attendance with 13 foundrymen from each.

Foundry Brochure Describes Ferrous Castings

RECENTLY PUBLISHED by the Hamilton Foundry & Machine Co., Hamilton, Ohio, is a 48-page illustrated brochure designed to provide casting users with information that will help them to understand ferrous castings and their many applications.

The brochure, *"Hamilton Quality Castings,"* contains dozens of photographs of typical and unusual castings, plus a history of the 75-year-old foundry. Copies may be obtained gratis from Hamilton Foundry & Machine Co., Hamilton, Ohio.

New Film on Foundry Core Practice

IN FULL COLOR, a half-hour, 16mm sound motion picture, *"The ADM of Cores,"* is a semi-technical discussion of basic foundry core practice designed to help foundries improve core production.

Narrated by a core room superintendent, the film shows performance of core materials at Archer-Daniels-Midland Co.'s Core Research Laboratory, and illustrates why different sands produce varied results in core mixtures; how to use water as a supplementary binder; what can be done to prevent the variations that cause defective cores and castings.

Prints of *"The ADM of Cores"* can be obtained gratis for showing to any foundry gathering, A.F.S. chapter meeting, apprentice training or school class, etc., by writing Archer-Daniels-Midland Co., Foundry Products Division, 2191 West 110th St., Cleveland 2, Ohio.

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AlSiMag Strainer Cores are made in many shapes and sizes. They fit in the gate of your mold and strain the incoming metal. Foundries using them report substantial reduction in rejects and improvement in smoothness and uniformity of castings. They are easier to handle—speed production. Store practically any place.

FREE SAMPLES of sizes in stock will be sent free on request. Samples specially made to your own specifications at moderate cost. Try them in your own foundry and see for yourself how AlSiMag Strainer Cores will save you money.

NEW PRICES

Demand for AlSiMag Strainer Cores far exceeded our highest estimates. New high production machinery now permits us to meet any reasonable delivery date.

WRITE for new quotations specifying size, type and quantity desired. Each item has been refigured on basis of improved production methods.

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FUTURE MEETINGS AND EXHIBITS

- **Oct. 15—AFS Quad City Chapter,** Fort Armstrong Hotel, Rock Island, Ill., W. F. Rose, Borden Co., *"Recent Developments in Shell Molding."*

Oct. 15-19. American Society for Metals, National Metal Congress & Exhibit, Annual Meeting, Michigan State Fair Grounds, Detroit.

- **Oct. 16. AFS Eastern New York Chapter,** Circle Inn, Lathams, N. Y., Fred W. Hanson, Electro Metallurgical Co., Division UCC Corp., *"Gray Iron."*
- **October 17, AFS Central Michigan Chapter,** Hart Hotel, Battle Creek, Mich., Frederick Wickert, Michigan State College, *"Selection of Supervisory Personnel."*
- **October 17—AFS Oregon Chapter,** Heathman Hotel, Portland, Jack Wright, Hyster Co., *"The Industrial Truck in the Foundry Industry."*
- **October 19—AFS Birmingham District Chapter,** Tutwiler Hotel, Birmingham, Ala., Fred O. Kramer, American Silica Sand Co., *"Traveling with a Grain of Sand."*
- **October 19-20—AFS Texas Regional Foundry Conference,** Shamrock Hotel, Houston, sponsored by AFS Texas Chapter and Texas A & M Student Chapter.

Oct. 19-20—New England Regional Foundry Conference, Massachusetts Institute of Technology, Cambridge, Mass.

- **Oct. 22—AFS Northwestern Pennsylvania Chapter,** Moose Club, Erie, L. P. Robinson, Archer-Daniels-Midland Co., film, *"The A-D-M of Cores."*

Oct. 25-26—Gray Iron Founders' Society, Annual Meeting, Edgewater Beach Hotel, Chicago.

- **Oct. 26—AFS Ontario Chapter,** Royal York Hotel, Toronto, Ont., Canada, H. H. Fairfield, Wm. Kennedy & Sons, Ltd., *"Casting Design."*
- **Oct. 26—AFS Tennessee Chapter,** Hotel Patten, Chattanooga, Sam F. Carter, American Cast Iron Pipe Co., *"Basic Lined Cupola."*
- **Oct. 26—AFS Chesapeake Chapter,** Engineers Club, Baltimore, Md., Richard Herold, Borden Co., *"Resin Bonded Core Sands and Shell Molding."*

Oct. 31-Nov. 2—Foundry Equipment Manufacturers' Association, Annual Meeting, The Homestead, Hot Springs, Va.

- **Nov. 1-2—Metals Casting Conference,** Purdue University, West Lafayette, Ind., sponsored by AFS Central Indiana and Michiana Chapters and Purdue.
- **Nov. 2-3—AFS Regional Conference and Problem Casting Forum,** Trois Rivieres, Que., Canada, sponsored by AFS Eastern Canada Chapter.
- **Nov. 5—AFS Metropolitan Chapter,** Essex House, Newark, N. J., J. E. Rehder, Canada Department of Mines and Technical Surveys, *"Graphitization of Iron."*
- **Nov. 7—AFS Mexico City Chapter,** National Engineering School, Mexico City, Mexico, S. C. Massari A.F.S. Technical Director *"Principles of Gating."*
- **Nov. 8—AFS St. Louis District Chapter,** York Hotel, St. Louis, Lee Everett, Lester B. Knight & Associates, Inc., *"Foundry Mechanization."*
- **Nov. 8-9—AFS Quad City Regional Foundry Conference,** Blackhawk Hotel, Davenport, Iowa, sponsored by AFS Quad City Chapter.

Nov. 8-10. Steel Founders' Society of America, Technical and Operating Conference, Carter Hotel, Cleveland.

- **Nov. 9—AFS Southern California Chapter,** Rodger Young Auditorium, Los Angeles, Ralph L. Lee, Grede Foundries, Inc., *"Do You Know Your Costs?"*
- **Nov. 12—AFS Central Ohio Chapter,** Springfield, Ohio, C. C. Drake, Oliver Corp., *"Safety and the Times."*
- **Nov. 12—AFS Western Michigan Chapter,** Morton Hotel, Grand Rapids, Mich., Thomas Campbell, *Iron Age, "Outlook of Iron and Steel."*
- **Nov. 12—AFS Cincinnati District Chapter,** Engineering Society, Cincinnati, Film—*"The A-D-M of Cores,"* Warner B. Bishop, Foundry Products Div., Archer-Daniels-Midland Co.



- **Nov. 12—AFS Northern California Chapter,** Hotel Shattuck, Berkeley, Ralph L. Lee, Grede Foundries, Inc., Milwaukee, *"Do You Know Your Costs?"*
- **Nov. 13—AFS Rochester Chapter,** Hotel Seneca, Rochester, N. Y., Clyde A. Sanders, American Colloid Company, *"Molding Sands."*
- **Nov. 13—AFS Twin City Chapter,** Covered Wagon, Minneapolis, F. B. Skeates, Link-Belt Co., *"Safety Through Mechanization."*
- **Nov. 13—AFS Northern Illinois-Southern Wisconsin Chapter,** Beloit Country Club, Beloit, Wis., Round Tables.
- **Nov. 14—AFS Oregon Chapter,** Columbia Athletic Club, Portland, Ralph L. Lee, Grede Foundries, Inc., *"Do You Know Your Costs?"*
- **Nov. 15—AFS Washington Chapter,** Frye Hotel, Seattle, Ralph L. Lee, Grede Foundries, Inc., Milwaukee, *"Do You Know Your Costs?"*

Nov. 19-20—National Metal Trades Association, Palmer House, Chicago.

- **Nov. 20—AFS Eastern New York Chapter,** Circle Inn, Lathams, N. Y., Clyde B. Jenni, General Steel Castings Co., *"Sand."*
- **Dec. 3—AFS Western Michigan Chapter,** Cottage Inn, Muskegon, Mich., Donald Colwell, Apex Metal Co., subject to be announced, and George W. Cannon, *"Trends of European Foundries Today."*
- **Dec. 4—AFS Rochester Chapter,** Hotel Seneca, Rochester, N. Y., Walter F. Bohm, Buick Motor Div., GMC, *"Cupola Operation."*

Dec. 6-8—American Institute of Mining & Metallurgical Engineers, Electric Steel Furnace Conference, Hotel William Penn, Pittsburgh.

- **Dec. 8—AFS Central Ohio Chapter,** Brookside Country Club, Columbus, Christmas Dinner Dance.

Dec. 10-15—Spanish Iron & Steel Institute, General Assembly, Madrid, Spain.

- **Dec. 13—AFS St. Louis District Chapter,** York Hotel, Christmas Party.
- **Feb. 7-8—AFS Wisconsin Regional Foundry Conference,** Schroeder Hotel, Milwaukee, sponsored by the AFS Wisconsin Chapter and U. of Wisconsin.
- **Feb. 21-22—AFS Southern Regional Foundry Conference,** Tutwiler Hotel, Birmingham, Ala., sponsored by the AFS Birmingham District and Tennessee Chapters and University of Alabama Student Chapter.
- **May 1-7—AFS International Foundry Congress & Show, Atlantic City, N. J.**

New England Founders Hear O. J. Myers

FIRST FALL DINNER meeting of the New England Foundrymen's Association, September 12, drew an audience of 126 to hear O. J. Myers, Archer-Daniels-Midland Co., Foundry Products Div., Minneapolis, on *"Core Sands and Binders."*

Mr. Myers used slides of testing equipment, and charts to illustrate his discussion of the need for keeping a constant check on the many variables in coremaking—such as screen analysis, grain size, etc.

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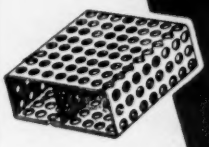


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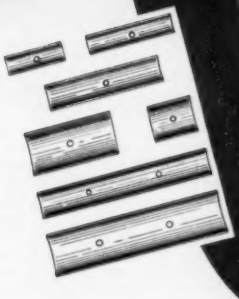
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FOUNDRY Literature

For additional information on Foundry Literature use postcard at bottom of this page.

Battery Technology Handbook

19—56-page revised edition of technical instructions and engineering data on care of storage batteries features a six-page section on battery charging. Included in the booklet are sections on the theory of lead-acid batteries; care and operation, maintenance and repair, parts and technical data on storage batteries. All sections of the booklet have been revised and greatly expanded over previous editions and contain charts, photographs and diagrams to illustrate the text. *Gould-National Batteries, Inc.*

Testing Machines

20—Eight-page folder illustrates and describes Amsler machines for test in tension, compression, torsion, shear, fatigue, bending and ductility. *Buehler, Ltd.*

Industrial Ventilation

21—Available upon request is the first issue of *Industrial Ventilation*, a new periodical devoted to latest developments in industrial dust and fume control. The issue contains case histories on applications of cloth-tube filters to dust control problems in various industries. Of special interest to ventilating engineers is an informative technical discussion on collecting efficiencies of cloth-type filters. *American Wheelabrator & Equipment Corp.*

Grinding References

22—New reference folder is designed to meet greatly increased demand for knowledge of grinding wheels and abrasives brought on by increased activities in defense plants. Listed are motion pictures, and all types of booklets and literature available on a wide variety of grinding subjects. *Norton Co.*

Cupola Charging

23—Second of a series of booklets on better foundry operation, "Tips on Improvising Cupola Charging," contains valuable information on obtaining a smoother flow of materials from freight car to cupola. Also described is how mechanical charging can improve and conserve manpower, how to get better loading and make-up, how improved charging benefits melting, and many other factors leading to lower cupola costs and increased output. *Whiting Corp.*

Mineral Perlite

24—Folder contains a reprint of a two-page article, *"Mineral Perlite—Foundry Uses,"* by Edward J. Boyle, master molder, Puget Sound Naval Shipyard, Bremerton, Wash., from the July, 1950, issue of AMERICAN FOUNDRYMAN, in which the author recommends use of mineral perlite for reducing solidification speed of molten metal and eliminating expansion defects. Also included in the folder are technical data sheets describing properties, applications and advantages of Skilcast A as a molding and core sand additive and as a riser insulator. *Perlite Division, Great Lakes Carbon Corporation.*

Casting Marking

25—Illustrated folder describes the various types of Markal Paintsticks for marking castings, ingots and other metal products. Diversified line of markers includes Markal H for high-temperature metal marking, Markal H-T for red-hot surface marking; Markal A for annealing and welding marking, Markal B-E for wide heavy marking on extremely rough surfaces, Markal C for marking cold surfaces of cold hot rolled steel, Markal D-A for

(Continued on Page 84)

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Reader Service (OCTOBER/51)

AMERICAN FOUNDRYMAN

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NAME_____ TITLE_____

COMPANY_____

ADDRESS_____ CITY_____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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121	122	123	124	125	126	127	128	129	130										

NEW Foundry Products

For additional information on New Products, use postcard at bottom of this page.

Casting Welding Electrode

1—EutecTrode 26, claimed by its manufacturer to be the first real improvement over conventional ferrous electrodes in the last decade, differs in that the carbon content in the deposited metal is evenly distributed. Analysis of metal deposited by the new electrode shows a uniform amount of carbon, so that the metal is similar to a high tensile, high carbon steel, thus increasing tensile strength of weld. *Eutectic Welding Alloys Corp.*

Rustproofing Treatment

2—Rustshield 2, a phosphatizing compound which changes steel and iron surfaces to rustproof, highly absorbent nonmetallic areas, provides base for the retention of lubricating oils. Surface coating is produced by chemical interaction of phosphate solution and metal surface, producing greater adherence than physical bond. manufacturer states. Rustshield 2 can be applied to rubbing and sliding surfaces of all precision parts and bearing surfaces. Although parts so treated are corrosion resistant, degree of this resistance can be increased by finishing with a drying oil or wax to utilize the phosphate coating's retentive qualities. Treatment does not affect close tolerances. *Oakite Products, Inc.*

Inexpensive Dust Mask

3—No. 35-33 dust mask is made from a soft, porous, absorbent vegetable fibre cloth that will not dissolve in water or live steam. Washable and sturdy enough for continuous use, masks protect workers from nuisance dusts while permitting free breathing and conversation with maximum comfort. These low cost masks are free from lint, may be re-used many times, and are finished with an elastic head band. *General Scientific Equipment Co.*

Air Grinder

4—Applicable to foundries and other metalworking plants where hand grinding is required for snagging, trimming and smoothing, new air grinder contains a motor governor to maintain correct wheel speed, plus an overspeed safety coupling. In case motor overspeeds because of governor wear, abuse, maladjustment or dirty air, coupling automatically uncouples arbor and grinding wheel from the motor. Other features include: safe-carrying grip handle; rubber-faced throttle valve unaffected by oil or moisture; independently mounted arbor; lightweight. Grinder is available for 5, 6 or 8 in. wheels, running at respective motor speeds of 4500, 4100 and 3100 rpm. Over-all length is 24½ in. with straight handle, and 22½ in. with grip handle. Weight is 16½ lb. *Ingersoll-Rand Co.*

Air-Pressurized Fire Extinguisher

5—Completely new 1-qt. air-pressurized fire extinguisher, the Alfco Pressurized Fire Gun, discharges vaporizing liquid fluid for extinguishing both flammable liquid and electrical fires. Aimed and operated like a gun, unit hits fire target accurately, with no loss of liquid, and is recharged by simply pouring in more vaporizing liquid. Unit can be pressurized with any standard air chuck. *American LaFrance Foamite Corp.*

X-Ray Storage Cabinet

6—Line of storage cabinets for x-ray dark rooms eliminates need for expensive, custom-built loading benches and wall closets. Available in 5, 6, 7, and 8 ft models, Workabinets provide a combination of work bench, storage compartment and shelf space for x-ray darkroom work. Loading bench is covered with formica or equivalent. The 7 and 8 ft models incorporate a wastepaper bin. Sections are available separately. *X-Ray Department, General Electric Co.*

Stock Toter

7—Universal Stock Toters, a new line of floor trucks, are sturdy, highly ma-

(Continued on Page 86)

Reader Service (OCTOBER/51)

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Please send me detailed information on New Foundry Products and Foundry Literature items circled below.

NAME _____ TITLE _____

COMPANY _____

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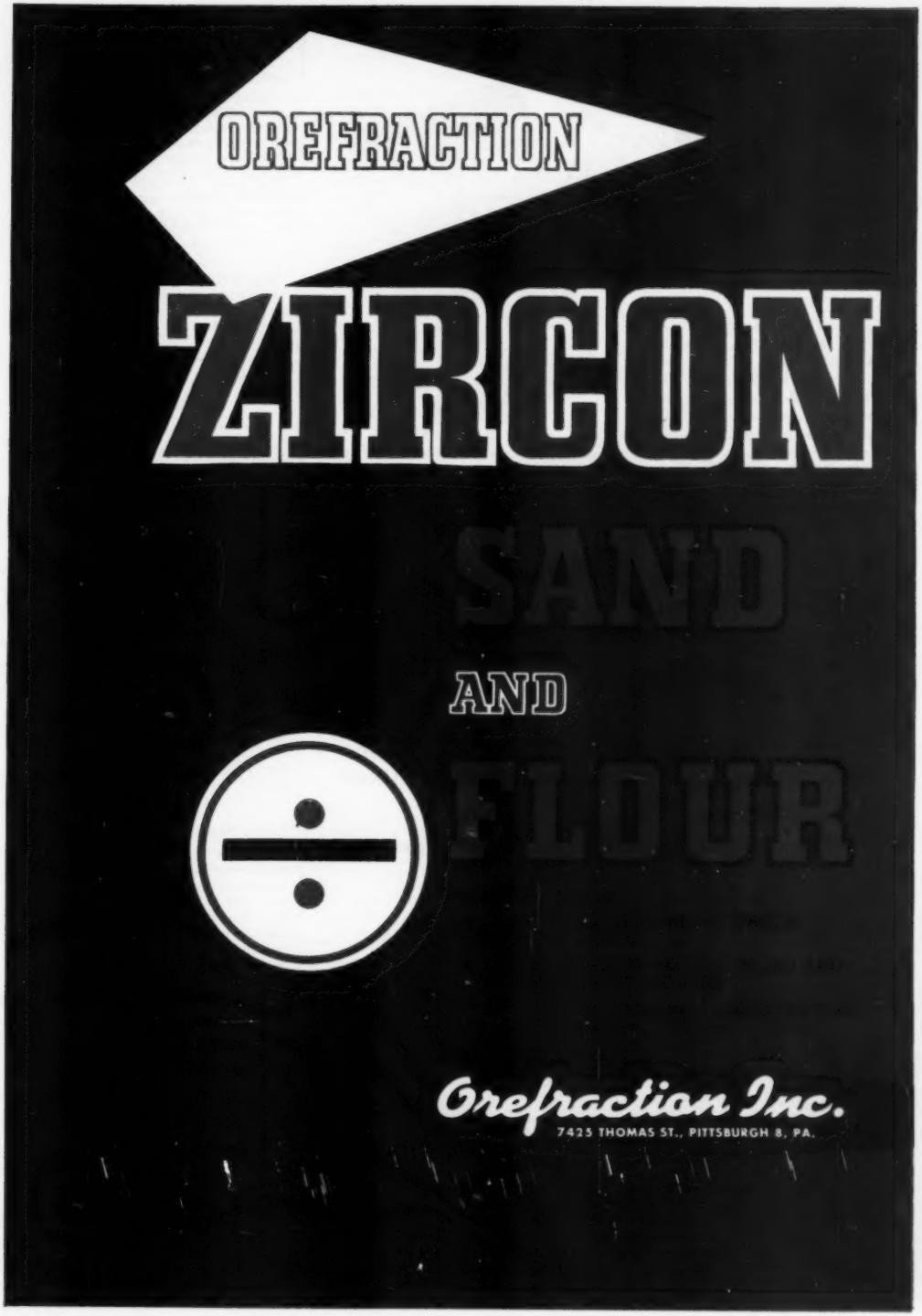
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Wichita, Kansas
Dallas, Texas
Houston, Texas
New Orleans, La.

G. W. Bryant Core Sands, Inc.
McConnellsville, New York

Lloyd H. Canfield Foundry Supplies
1721 Minnesota Ave.,
Kansas City, Kas.

Combined Supply and Equipment Company
215 Chandler St.,
Buffalo 7, N. Y.

The Foundries Materials Co.
Coldwater, Mich. Also—
(Branch) Detroit, Mich.

Foundry Service Company
North Birmingham, Alabama

James R. Hewitt
Houston, Texas

Interstate Supply & Equipment Co.
647 West Virginia St.,
Milwaukee 4, Wis.

Independent Foundry Supply Co.
Los Angeles, California

Industrial Supply Co.
San Francisco, California

Klein-Farris Co., Inc.
Boston, Massachusetts
New York - Hartford, Conn.

LaGrand Industrial Supply Co.
Portland, Oregon

La Salle Builders Supply, Ltd.
Montreal, Quebec, Canada

Marthens Company
Molina, Illinois

Carl F. Miller & Co.
Seattle, Washington

Pennsylvania Foundry Supply & Sand Co.
Philadelphia, Pennsylvania

Refractory Products Co.
Evanston, Illinois

Robbins & Bohr
Chattanooga, Tennessee

Smith-Sharpe Company
Minneapolis, Minnesota

Steelman Sales Co.
Chicago, Illinois

Stoller Chemical Co.
227 W. Exchange Ave.
Akron, Ohio

Wahenn Abrasive Co.
Chicago, Illinois

Mr. Walter A. Zeis
Webster Groves, Missouri

LITERATURE

(Continued from Page 82)

marking metals and lumber that are to be subjected to steam conditioning or cleaning solutions and solvents, Markal L for fast-drying marking of lumber, and Markal N for layout work, where quick drying is a necessity. Simplified chart shows how to choose correct Paintstick for each job. *Markal Company.*

Ferrous Castings Booklet

26—New 48-page booklet, "Hamilton Quality Castings," profusely illustrated, is designed to show castings users the many applications of a wide range of light and medium castings produced in gray iron and alloy irons. A section in full color illustrates a number of interesting examples of cast iron art. *Hamilton Foundry & Machine Co.*

Industrial Film Catalog

27—Available gratis to industrial plants and offices, 60-page illustrated catalog describes more than 1,400 educational, recreational and training films. Of interest to personnel and recreation directors are the sponsored films, available for plant showings at no other charge than transportation. These outstanding subjects, many in full color, are designed for employee recreation programs and lunch hour showings. Film selections include science and manufacturing, travel, health and safety, transportation, home economics, civil defense, as well as purely-entertainment films. *Association Films, Inc.*

Metal Reclaiming Mill

28—Six-page folder describes a metal reclaiming mill for reclaiming all molten metal from waste materials produced in foundry melting. Diagrammatic chart shows how machine operates, and specifications are given for four standard-sized units. *Dreisbach Engineering Corp.*

Aluminum Casting Alloys

29—Data sheet, "Guide to the Selection of Aluminum Casting Alloys," has been completely rewritten in terms of British Standard 1490 "LM" specifications. Given are aluminum alloy characteristics in sand casting, gravity die casting, pressure die casting, fluidity, resistance to hot tearing, corrosion resistance, weldability, density, thermal expansion, tensile strength, proof strength, elongation, strength at elevated temperatures, etc. *Alar, Inc.*

Metal Surface Primer

30—Four-page folder describes how Ospho, a metal primer applied directly over rusted surfaces, stops rust and primes metal for paint. Advantages, prices, container types and data are included. *Rusticide Products Co.*

Meehanite Anniversary

31—Four-page booklet, "25 Years of Proof in Service," commemorates Meehanite Metals Corp.'s Silver Anniversary and provides a number of case histories of unusual applications of Meehanite castings in various industries. *Meehanite Metals Corporation.*

ABSTRACTS

Abstracts below have been prepared by RESEARCH INFORMATION SERVICE of The John Crerar Library from current American and foreign literature. For literature searches and translations of technical, industrial, and scientific literature, and photostats and microfilm, write to: Research Information Service, The John Crerar Library, 86 East Randolph Street, Chicago 1, Illinois. Rates for above services given on request.

Specify Steel Casting Method

A149—CONSIDER ALL FACTORS. A. C. Williams, "The Plus and Minus of Steel Precision Investment Castings," *Materials and Methods*, vol. 33, May 1951, pp. 88-90.

Investment casting of steel and high temperature alloys is complementary to other fabrication methods and should only be used where its inherent advantages can be capitalized on. Before the lost wax method of precision casting is specified for a part, the problem should be studied from four points: size of the casting, dimensions and tolerances, metallurgical quality, and cost. Each of these aspects is discussed in detail.

Set Up Research Foundry

A150—SPACE AND EQUIPMENT. Harold J. Roast, "Research and Pilot Foundry," *Metal Progress*, vol. 59, May 1951, pp. 668-669.

A pilot foundry is suggested for conducting investigations and research. Ideal specifications for such a pilot foundry are presented. The essential equipment would consist of a melting unit, a standard wall pyrometer, steel flasks, molding sand, core sand, a small core oven, and a molder's bench. Breaking machinery, a small band saw, and a simple hydraulic machine are also recommended.

Cleaning Gray Iron Castings

A151—PRODUCE GOOD SURFACE. R. J. Peters, "Automatic Transmission Castings Cleaned Chemically," *The Iron Age*, vol. 167, March 15, 1951, pp. 105-107.

A new adaptation of the Kolene cleaning technique produces gray iron automatic transmission castings of unusual surface quality. Surface sand inclusions are dissolved, and all scale and rust are removed. Machine shop rejects are minimized, since the process uncovers porosity and cracks for visual inspection.

Pig Iron Process Developed

A152—LARGE TONNAGE FROM SMALL FURNACE. B. M. Pearson, "Germans Make Pig Iron Without Coking Coal," *The Iron Age*, vol. 167, Jan. 11, 1951, pp. 71-72.

The Humboldt distillation process for the continuous production of pig iron in a low-shaft blast furnace is described. The process was first developed during the war by L. Weber in conjunction with the Kloeckner-Humboldt-Deutz concern in Germany and has been modified; ore fines and a noncoking-coal are continuously added to the furnace in the form of briquettes. The new furnace is only one third the size of conventional blast furnaces, yet tonnages of iron from both units are equal.

Casting Performance

A153—CONTROL METHODS AND MATERIALS. "Foundry Technical Control," *Iron and Steel*, vol. 23, Dec. 1950, pp. 491-495.

The foundry of the Distington Engineering Co., Ltd. has set up a system designed to correlate the service given by ingot molds with variations in the methods and materials used in production. The methods by which the necessary information is obtained during the production of these molds are described.

Gates and Risers

A154—PRACTICAL DESIGN FACTORS. H. S. Farmer, "Running and Feeding of Castings," *Canadian Metals*, vol. 14: (no. 7), July 1951, pp. 18-22, 48.

Two basic requirements in a runner system are: controlled pouring speed to fill the cavity as swiftly as possible, and distribution of the metal so as not to create turbulence. The feeder head should fulfill three requirements: sufficient volume to compensate for volume contraction, sufficient heat to set up the necessary temperature gradient, and the feeder metal should remain liquid while the cast

(Continued on Page 95)



NEW PRODUCTS

(Continued from Page 81)

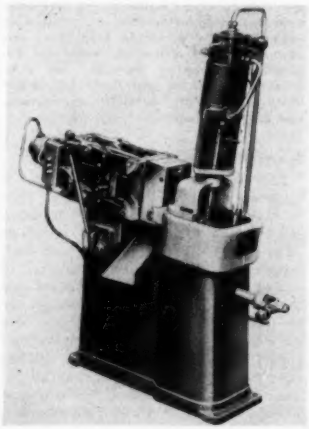
neuverable and designed for such jobs as line stocking, machine stocking, moving work parts, and conveying smaller parts in stockroom or shipping department. Dimensions of container are 30 x 24 x 10 in. deep. Truck height from floor to top is 34⅛ in., with 4-in. casters. Lower shelf attached to frame just above casters is available if desired. *Industrial Engineering & Mfg. Co.*

Propeller Pump

8—Oil-lubricated bearing, pedestal-mounted pump is designed to handle chemicals, corrosive materials and solutions, hot liquids and petroleum. Completely self contained unit is available in monel metal, nickel, stainless steel or other special material when used for pumping liquids that attack iron or bronze. Two sizes of pedestal assembly cover the entire range of pump sizes available in capacities to 1200 gal per min at heads to 250 ft and temperatures to 500 F. *Allis-Chalmers Mfg. Co.*

1-Lb Die-Casting Machine

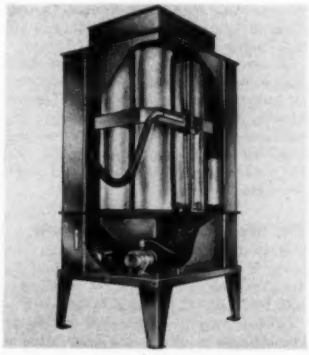
9—All features of the DCMT M55A die-casting machine, plus the added advantage of a pilot-operated, impact-type injection cylinder with slide valve in the head, are available in the IMP/96 1-lb die-casting machine. Injection cylinder is controlled by fingerlight trip lever and employs a safety interlock valve to prevent metal injection before dies are fully closed. Thus, higher pressure can be exerted on



molten metal from normal airline pressures (80-100 lb), giving more uniform and homogeneous castings. Larger and heavier castings can be produced than by previous methods. Model IMP/96 operates on standard 80 psi airline, consuming only 55 cu ft of free air per cycle of operation. Specifications available on request. *DCMT Sales Corp.*

Dust Collector

10—Aeroturn Series 18 bag-type dust collectors feature a self-adjusting blow ring that travels up and down the filter bag's circumference, flexing it slightly and directing a high-pressure reverse air jet into the bag from all sides. The flexing and jet combine to dislodge dust that has



accumulated on inside of bag. Dust then drops into hopper. Claimed for the Series 18 Aeroturn are: 99.9 per cent collecting efficiency; maximum product recovery; automatic cleaning of filter media during operation; filtering rates up to 60 fpm; low operating and maintenance costs; re-

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• SPECTROCHEMICAL ANALYSES
Qualitative and Quantitative

• PHYSICAL TESTING

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• METALLURGICAL CONSULTING ENGINEERS
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• FOUNDRY CONSULTING ENGINEERS
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Since 1903

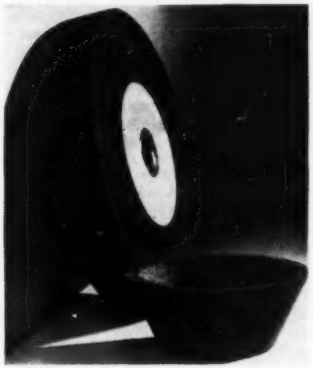
Charles C. Kawin Company

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CHICAGO 5, ILL.
●
37 FRANKLIN ST.
BUFFALO, N. Y.

duced health and fire hazards; and fuel savings through air recirculation. Aeroturn collectors can be supplied in sizes and arrangement to suit any installation requirements, inside or out. Available in two-bag up to 32-bag units, with bags up to 20 ft high. *Turner & Haws Engineering.*

New Grinding Wheel Bond

11—An entirely new grinding wheel bond for tungsten carbide tool sharpening, XL, is claimed by its manufacturer to make



Chicago vitrified silicon carbide grinding wheels superior to any now on the market and to effect time and cost economies. Recommended for offhand or precision grinding of carbide tools, XL bonded wheels are tough and long-lasting and provide unprecedented cutting action that is both cooler and faster than conventional silicon carbide wheels. XL wheels are available in standard straight and cup wheel sizes and steel backs. *Chicago Wheel & Manufacturing Co.*

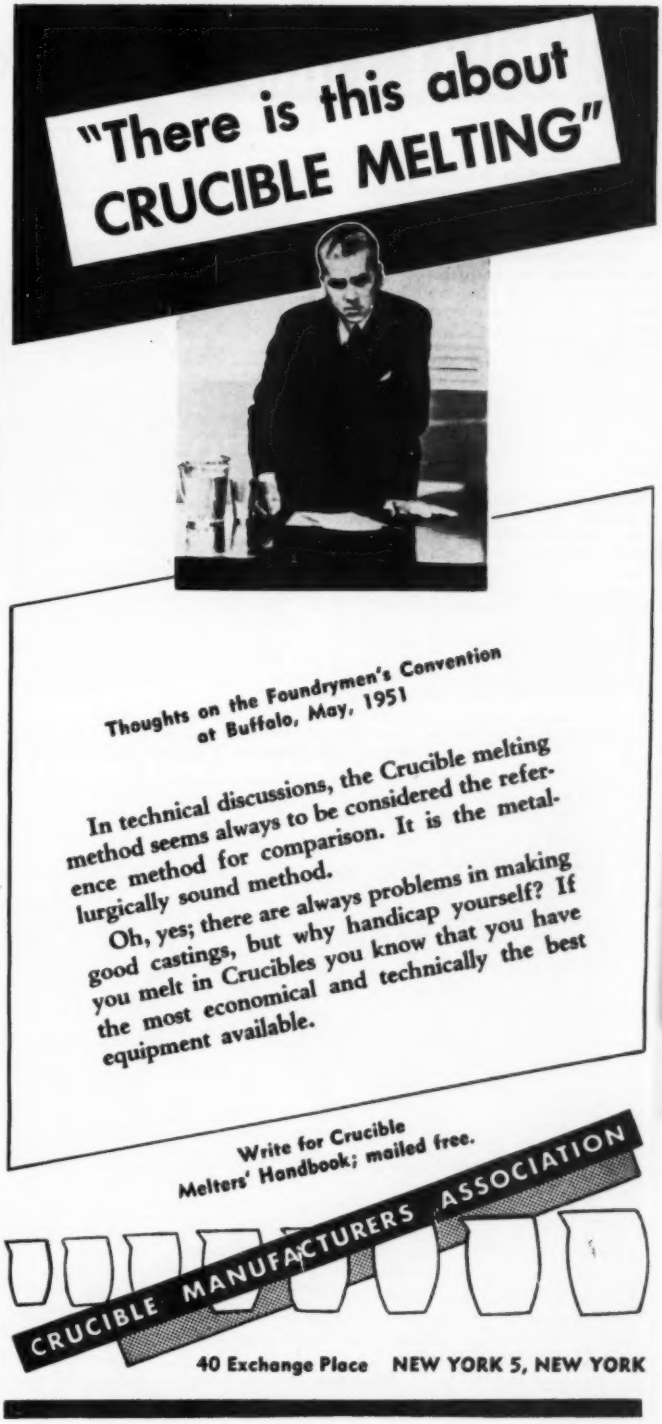
Melters Carbon Tester

12—Melters Carbon Tester determines carbon in mild steel baths in less than one minute directly on the melting floor. Under controlled conditions, hardness tester graduated in per cent carbon gives carbon results to within .02 per cent in the .05 to .45 per cent carbon range. Test may be applied to any non-austenitic molten steel up to .60 per cent carbon and unit saves valuable furnace time by eliminating waiting for laboratory preliminaries. *Harry W. Dietert Co.*

Diesel Fork Lift Truck

13—Diesel-powered fork lift truck with hydraulic transmission, the Diesel-Lift, is specifically designed for applications where fire hazards exist, where fresh air is limited, and outdoors where continuous heavy-duty operation is necessary. Truck has a Hercules 6-cylinder diesel engine with continuous rating of 70 hp and is equipped with governor controls. Features: long-wheelbase and wide treads; 9-in. chassis clearance; corrosion-proof operating and steering connections; flat sidewall tires; full operator vision; easy steering. Specifications: over-all height 88½ in; wheelbase, 72 in.; primary lift,

(Continued on Page 92)



FOUNDRY FIRM *Facts*

H. L. E. Meyer Jr. & Co., suppliers of foundry cokes and pig iron, announces the removal of its main offices to 149 California St., San Francisco 11.

Federated Metals Div., American Smelting & Refining Co., has purchased **Frictionless Metal Co.,** St. Louis bearing metal manufacturers. Name and formula of Frictionless Bearing Metal will be retained by Federated, which will distribute it across the country and will maintain stocks at all its plants. Frictionless will become, with XXXX Nickel and Merit Metal, one of Federated's "Big 3" babbits, designed with a range of properties to answer practically every maintenance bearing metal need.

Battelle International, new international research institute to be established in Europe this fall by **Battelle Memorial Institute,** Columbus, Ohio, will maintain laboratories and offices in several western European countries and will place investigations in existing European research institutes, universities and technical schools. Battelle International will conduct nonprofit research for the benefit of the European economy in such fields as metallurgy, fuels, applied chemistry and physics and the engineering sciences. The first year's operating costs will probably exceed $1,500,000, to be financed by both American and European industry and by Battelle endowments. A three-man team made up of John S. Crout, who will direct Battelle International, Dr. B. D. Thomas and W. R. Keagy has opened negotiations for laboratory sites and is recruiting a European staff.

National Lead Co., New York, announces acquisition of the capital stock of the Charles Taylor Sons Co., manufacturers of special refractories. The Taylor company will be operated as a wholly-owned subsidiary of National Lead under its present management, with main offices and plant at Cincinnati and another plant at Taylor, Ky. The Taylor company was founded in 1864 to manufacture fire clay brick. In 1926 it began production of bonded super refractories, and in 1933 added zircon refractories to its line.

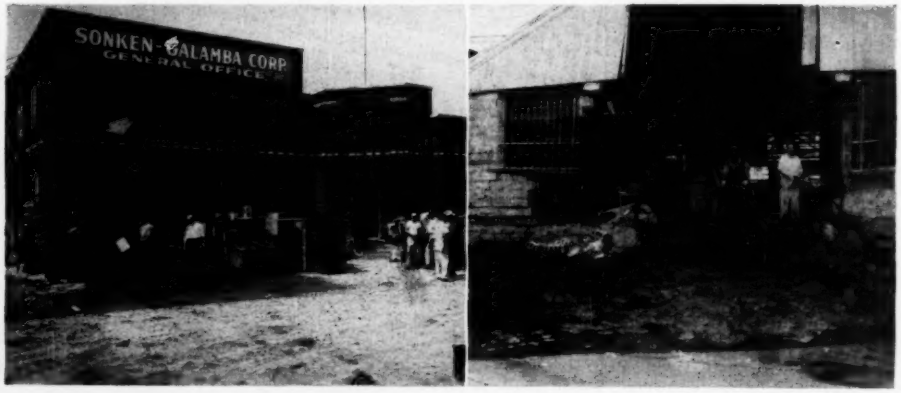
Valley Foundry & Machine Works, Fresno, Calif., has completed a $400,000 plant just south of Fresno on the Golden State Highway. Valley Foundry specializes in cast stainless specialties for wineries, pulp and paper mills, and other processing industries.

Canadian Allis-Chalmers (1951) Ltd. has purchased the St. Thomas, Ont., Works of **Allis-Chalmers Rumely, Ltd.** Transfer of the St. Thomas Works from one Allis-Chalmers subsidiary to another is in line with the parent company's corporate structure and places all Canadian manufacturing operations of the General Machinery Division under a single management.

General Refractories Co. opened its new Chicago sales warehouse at 4242 West 45th St. on August 22. The 10,000 sq ft warehouse stores a complete line of clay, silica, basic and sillimanite brick, and refractory specialties.

Federated Metals Div., American Smelting & Refining Co. has opened a Midwestern department comprising Federated operations in North and South Dakota, Minnesota, Michigan, Wisconsin, Indiana, and parts of Illinois, Iowa, Ohio and Kentucky. Carl J. Gross has been named general manager of the new department and will continue to direct the company's

Rampaging Midwest Rivers Damage Smelting Plant



Back in production after suffering severe damage from the greatest floods in Kansas history are Sonken-Galamba Corp.'s main offices and ingot smelting plant and warehouse at Kansas City, Kansas. The 17-acre plant's facilities, including aluminum smelting furnaces, were in full operation on July 13 just an hour before the flood broke through what had been believed to be an impregnable 35-foot dike. When the water receded, office furniture, walls and ceilings were completely ruined (arrow shows high water mark). Laboratory equipment, ingot furnaces and stocks were damaged badly, some beyond repair. Since that time, everyone in the plant has pitched in to clean out the tons of debris left in the flood's wake, repairing damaged equipment, etc., with the result that the plant is back in operation only 60 days after the flood.

Whiting, Ind., plant. Former Detroit sales manager Allan Nichamin succeeds Robert Ruch, resigned, as Detroit plant manager, and John W. Kelin has been named Midwestern sales manager.

Allis-Chalmers Mfg. Co.'s Ironwood (Ohio) Works is constructing an 80 x 210 ft non-ferrous foundry building, expected to be in operation by the third quarter of 1951, General Manager J. D. Greensward states.

Hyster Co., Portland, Ore., recently had three changes in its Eastern Division industrial truck and tractor equipment personnel—J. W. Morgan, assisant sales manager, Eastern tractor equipment division, to be manager, North Central District; and Donald R. Shaffer, North Central District manager, to succeed John E. Mitchell as Northeast district manager. Mr. Mitchell has joined Field Machinery Co., Boston.

National Malleable & Steel Castings Co. has received the go-ahead from the government to expand its Chicago area plants at Cicero and Melrose Park, Ill.

International Graphite & Electrode Corp., New York, has been issued a Certificate of Necessity permitting five-year amortization for tax purposes of 75 per cent of an estimated $8 million construction cost of facilities for producing electrodes.

Lakey Foundry & Machine Co., Muskegon, Mich., plans to install an improved mechanical charging system and a new and larger cupola in its No. 5 foundry at a cost of about $250,000, bringing Lakey's total postwar modernization and expansion cost to $2,500,000. Major changes in Lakey plant layout have been effected in recent years, including installation of almost a mile of power conveyors for cooling hot castings, six vertical core baking ovens, a sand drying system, a hot blast unit, and new coremaking, molding, shotblast and shakeout equipment.

Kaiser Aluminum & Chemical Corp. announces that construction is under way at its Jamaica, British West Indies, bauxite deposits to supplement present aluminum ore sources by one million tons a year. Proximity of these reserves to Kaiser's Baton Rouge, La., alumina plant will reduce present shipping distances by half.

Grede Foundries, Inc., Milwaukee, has employed the first group of German expellees to arrive in this country through the job-screening process of the U. S. Displaced Persons Commission. The 27 foundry workers were forced by Communists to leave six Iron Curtain countries because of their German ancestry. They represent four religious faiths—Catholic, Protestant, Orthodox and Moslem. Both Grede Foundries and Belle City Malleable Iron Co., Racine, Wis., have agreed to employ a total of 172 foundry workers, all single men. The group of 27 is the first contingent to arrive. The others are awaiting visas. All but four men are under 30, and 10 are only 19 years old. Each has been thoroughly screened for political back-



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ground, and has been subjected to a rigid physical examination. Under the Commission's pre-processing plan, many other skilled workers await assurances from sponsors in the United States. Among these are 21 molders, 120 other foundry workers, 111 welders and 135 machinists.

Traceriab, Incorporated, and **Bendix Aviation Corp.** have signed contracts with the Atomic Energy Commission to study at their own expense the commercial feasibility of manufacturing, processing and selling radio-isotopes. First step will be to study AEC's isotope processing program and to investigate the possibilities of building and operating reactors to produce isotopes.

Whitehead Metal Products Co., Inc., was recently host at its new Buffalo warehouse to area foundrymen for a three-day Welding & Brazing Clinic, September 26, 27 and 28. Technicians from 16 major metals supply companies conducted daily demonstrations of all forms of welding and brazing. Other program features were open forums on Inert Gas Shielded Arc Welding, Hardfacing and Flame Hardening, Opportunities for Success in Job Shop Welding, Resistance Welding and Silver Brazing. Foundrymen were invited to bring sample welding problems to be presented before a five-man panel for discussion and analysis.

Builders Iron Foundry, Providence, R.I., recently conceived a new approach in customer relations when it invited design engineers, draftsmen, production engineers, supervisors, inspectors and purchasing agents to attend a five-day course in Foundry Practice and Casting Design. Limited to 25 students, the school opened on September 17. Thirty-nine hourly lectures were given on eight phases of castings practice and design. In addition to Builders Iron technical personnel, the teaching staff was made up of representatives from nine other companies.

Kirk & Blum Mfg. Co., Cincinnati fabricators and erectors of dust-collecting and fume removal systems, has completed the first phase in modernizing its plant facilities. Last April, Kirk & Blum moved into a new one-floor 120,000 sq ft building, whose facilities include a complete overhead crane system, and exterior and interior rail sidings.

Electro Metallurgical Co. A Division of Union Carbide & Carbon Corp., began production at its huge new ferro-alloy plant at Marietta, Ohio, September 4. One of the largest of its kind in the world, the Marietta plant is equipped to manufacture some 50 major alloys produced by Electromet, plus a new ferrochrome product for making stainless steel and relieving the critical shortage of columbium. First products to be made at the new plant will be alloys of silicon, manganese and chromium. The Marietta plant is the closest of Electromet's nine alloy-producing plants in the United States to principal steel-consuming areas.

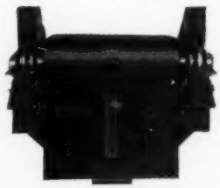
Read this if you are the man who worries about Grinding Wheel Costs—

• Your grinding wheel costs may be reduced in two ways: 1, by making certain that the wheels you use are the best and most suitable for the job; and, 2, by making sure that wheel waste caused by machine vibration is kept to a minimum.

• Your supplier will help you find the right wheel for each job. The more accurate the selection, the more production, and—assuming also the right wheel speed—the lower the wheel cost per job or per pound of metal removal.

• There's little to be gained, however, from saving at the spiggot and wasting at the bunghole: the men of the laboratories, behind the man who is selling you the wheels, have determined that rough wheel rotation—as prevails with a light machine spindle whip or poorly fitted bearings—will cause as much as 40% *increase* in rate of wheel wear, no matter how suitable the wheel for the job. Obviously, then—for maximum wheel economy—you should employ the *combination* of the right wheels on well-designed, well-supported, smoothly rotating spindles.

• Only a very small percentage of a single year's snagging wheel expenditures will pay the difference between the price of a Marschke Grinder and the price of a less carefully designed, lighter machine . . . a difference which the Marschke quickly earns for you—in savings on wheel costs. Consider, too, that the dependability of a Marschke assures a *repetition* of these earnings *each year* during many years of uninterrupted service.



Marschke Floor Stand Grinder. Double end spindle for two 24″ x 4″ wheels driven by one 15 HP motor *and variable speed drive.*

• Marschke models of design similar to the above are available with 5 to 40 HP motors. Various sizes of two-spindle Floor Stands with two independently operated motors—all with choice of single, multi- or vari-speed drives—and a complete selection of Swing Frames are included in the Marschke line. There is a Marschke Grinder to fit most any foundry condition and requirement.

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LETTERS

(Continued from Page 57)

More On Sand and Shrinkage

I am grateful to Professors Sigerfoos and Womochel and Mr. Sanders for their detailed replies to my letter (AMERICAN FOUNDRYMAN, August 1951, page 65).

Professor Sigerfoos is correct in assuming that I had not read Walter F. Bohm's paper, *"Mold Materials are Factors in Gray Iron Shrinkage"* (AMERICAN FOUNDRYMAN, January 1951, page 26). This was indeed an unfortunate oversight since this paper provides evidence which I felt was lacking in the companion paper, *"Gray Iron Shrinkage Related to Molding Sand Conditions,"* (AMERICAN FOUNDRYMAN, February 1951, page 49). This evidence is impressive and leaves me in no doubt that there is a correlation between sand properties and a particular shrinkage defect—to use Bohm's words "the shrink or draw."

It does not follow that there is any correlation between sand properties and other types of shrinkage defects.

In my original letter, I did not deny the possibility that draws and pipes in risers could form by the mechanism postulated, but did not consider the evidence conclusive. What I did deny was that the mechanism would account for an internal shrinkage cavity not connected with the atmosphere.

With regard to Professor Sigerfoos' point governing the mechanism of solidification of gray irons, I am, of course, aware that gray iron castings do not solidify by a simple skin formation process like a pure metal. But surely he does not wish to maintain that so long as the center of a casting contains liquid the outer shell has no rigidity at all. If that were so then the top of a riser would sink down uniformly instead of piping.

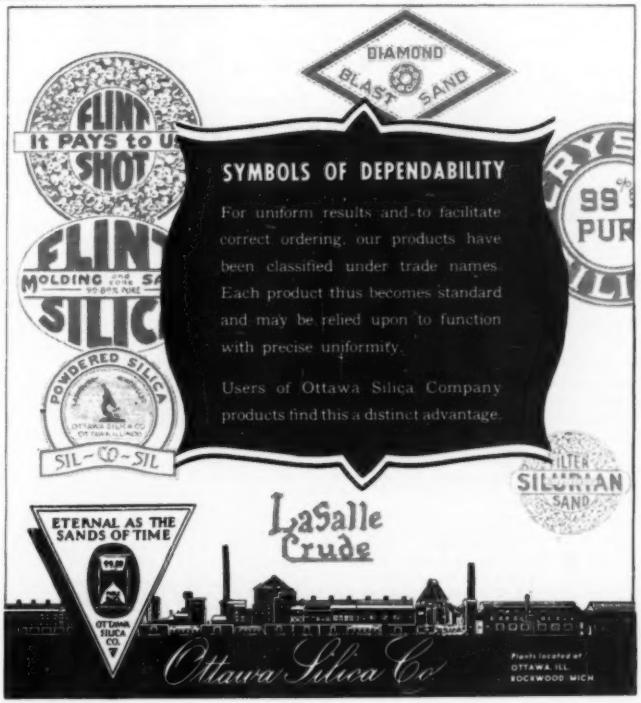
It is not my intention to criticize the size of the riser used by Sanders and Sigerfoos, but I do consider that having chosen a riser of a size that would freeze before the casting, they should have sectioned the casting as well as the riser to see how effective the riser had been. Furthermore, in this type of experiment it is surely advisable to repeat some of the work exactly to see whether the results are always the same. I am still doubtful about the reproducibility of the form of a pipe under the experimental conditions used.

As regards experimental evidence it seems to me that since I proposed no theory of my own nor claimed to refute any theory, I was not required to produce any evidence. We have, of course, carried out experimental work at the British Cast Iron Research Association in connection with shrinkage problems in gray iron castings, and a team (of which I am a member) is currently concerned with these problems, but we do not yet feel justified in drawing any conclusions.

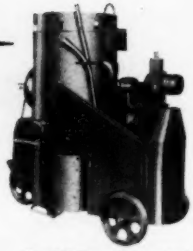
Finally, I agree that in considering any shrinkage problem the sand variables may be possible contributary factors.

J. E. SRAWLEY
British Cast Iron Research Assoc.
Alvechurch, England



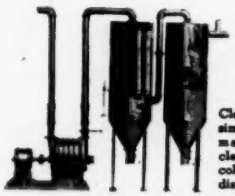


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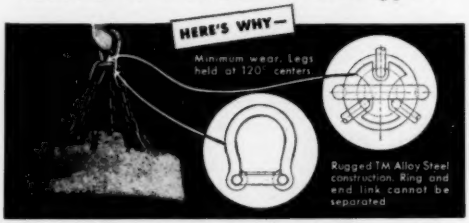
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NEW PRODUCTS

(Continued from Page 89)

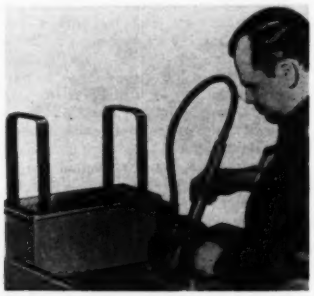
66 in.; over-all height channel, 85 in.; forward tilt, 5 degrees; rear tilt, 15 degrees; length to fork face, 113½ in.; weight



of truck, 9600 lb; over-all width, 62 in.; speed, 13 mph; 220 rpm engine. *Yale & Towne Manufacturing Co.*

Bench-Type Parts Cleaner

14—Brush-Flush, a low cost bench-type parts cleaner, features a hollow handle attached to a pump to produce a steady flow of clear solvent at the end of the bristles. Oil, grease and dirt are flushed away as they are loosened with the brush. Cleaning solution is double filtered. Parts are cleaned on a large screen platform to capture dirt flushed off the parts, and small particles are retained by the baffle or second screen at pump intake. A 2½-gal soak tank with dip basket, independent of

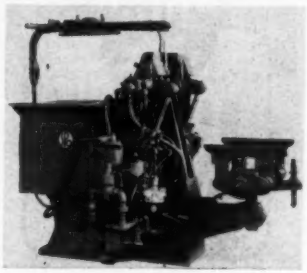


main tank, can be used with Graymills UL solvent, or other solution. *Graymills Corp.*

Pattern-Draw Machine

15—Model 5050 jolt rock-over pattern-draw machine features twin 5-in. jolt cylinders for both jolting and drawing operations. The two pistons operate in tandem against each other, eliminating need for external guides. Unit has 600-lb jolt capacity on a standard 80 psi line pressure, and a 10-in. pattern-draw stroke. Having open ends, it can handle flasks of any length and up to 27-in. wide. Maxi-

mum flask space is 18 in., and minimum 13½ in. Machine employs two integrally mounted 1¼-in. air vibrators. Features: automatically locked rock-over table; one-piece, precision-cast steel rock-over table; replaceable wear strips on jolt table; quick-



acting air-operated diaphragm flask clamp; centralized controls; adjustable air-locked leveling bars; single valve control of both flask clamp and leveler; automatic control valve for rock-over operation; and adjustable two-speed draw. *Spo, Inc.*

Band Saw Table Mount

16—Important design change in mounting of saw tables for DoALL Contour Machine line increases rigidity, minimizes deflection under load, eliminates work table vibration, and still maintains a universal two-way tilt for angle cutting. Due to the new design, lower saw guides can be



raised above work table surface to give increased blade support. Deflection readings indicate the new design, which employs a 5½-in. wide cradle and fitted trunnion, is 300 per cent more rigid than conventional table mountings. *DoALL Co.*

Wet Blast Machine

17—Liquamette, an entirely new wet blast machine, is the result of intensive field surveys wherein foundries and other metalworking plants were asked to specify features they wanted most in a unit of this kind. As a result, the Liquamette features a vertical pump for slurry recirculation; is so positioned as to eliminate need for suction piping, valves, fittings and labor required for pump inspection; is always primed by flooded-type suction; and requires no valve operation for starting or stopping. Abrasive cannot plug pump propellor when machine is shut down, and hopper need not be drained before pump

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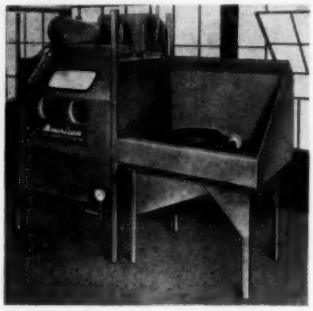
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is removed. Machine has low work ceiling, but is sufficiently high off floor for good housekeeping. Rubber is used instead of pipe wherever possible. Armholes are equipped with gauntlets so every workman can use his own gloves and small work can be passed through armholes without opening the doors. Reset timer tells at a glance number of blasting hours work has been in the machine, and an air



ejector is available for blowing slurry through hose to sump pit or barrels. Machine is intended to perform work for which dry blasting is too severe. Abrasive sizes available range from 80 to 2500 mesh. *American Wheelabrator & Equipment Corp.*

Hoist Binder

18—Hoist-binder, working on ratchet-hoist principle, will take up or slack off a load chain up to 20½ in., or more if a longer chain is used in the binder. This advantage is especially important where springy loads require that the chain or



cable be tightened by force to fully secure the load. If a load settles in transit, hoist-binder is easily tightened without releasing load for a new grab. Full strokes can be used for rapid take-up; half-strokes permit minute adjustments. Binder chain may be pulled freely through ratchet when not under load. Weight 10 lb. *Coffing Hoist Co.*

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BLAST FURNACE
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OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICHIGAN

ABSTRACTS

(Continued from Page 85)

ing is undergoing the change from liquid to solid. A discussion is presented of the practical aspects involved in the design of runners and feeders, with a view to help control foundry practice and thereby reduce scrap.

Glass Tubes Reinforce Cores

A155—PRECISION CASTING PRACTICE. D. D. Malcomb, "Glass Solves Delicate Coring Problems," *The Iron Age*, vol. 167, April 12, 1951, pp. 107-109.

Precision investment casting was selected as the speediest and most economical means for producing radar tube-feed antenna units. The necessarily fragile cores were reinforced with pyrex glass tubes, enabling them to withstand the turbulence and shock of the metal entering the cavity.

Brass Surface Defects

A156—SAND INCLUSIONS. H. H. Symonds, "Cast Letter Plates," *Metal Industry*, vol. 78, June 1, 1951, pp. 447-448.

A study was made of surface defects in cast brass and gunmetal letter plates. These defects took the form of numerous isolated inclusions in the polished surface, and became apparent only after a certain amount of polishing had been carried out. These inclusions have been definitely identified as black sand particles. The use of Mansfield sand is recommended to reduce the incidence of surface defects.

Aluminum Alloys Nomenclature

A157—MANY SYSTEMS USED. W. G. R. de Jager, "The Naming of Aluminum Alloys," *Metalen*, vol. 6, March 15, 1951, pp. 69-76.

A discussion is presented of the various nomenclatures used to describe aluminum alloys. The systems used in the United States, Great Britain, France, Germany and Switzerland are described, and examples are given to illustrate the naming of several alloys.

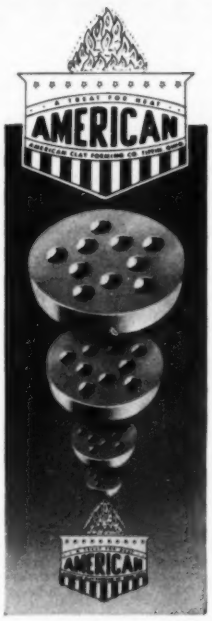
Die-Casting Process

A158—MATERIALS, PRACTICE, AND ECONOMICS. J. A. De Kiewiet, "The Process of Die-Casting," *The Engineer and Foundryman*, vol. 15, (no. 12), April 1951, pp. 47, 49, 51, 53, 99, 101; 16: (1) 81, 83.

Die-casting is the process of producing accurately dimensioned parts by forcing molten metal under mechanical pressure into metal dies or molds. Among the advantages claimed for die-casting are: rapid and economically repetitive production of large quantities; production within remarkably close dimensional limits, often in complex shapes which are difficult or impossible to machine; reduction in subsequent machining and finishing operations required; and superiority of die castings to corresponding alloy cast in sand molds, as regards mechanical properties. A detailed discussion of the die-casting process includes a treatment of the principal materials used, pressure die-casting practice and limits to the size of die-castings. Castings using zinc, aluminum and copper alloys are considered separately in this article.

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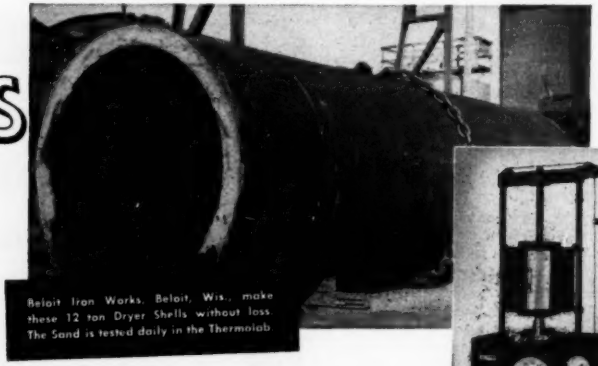
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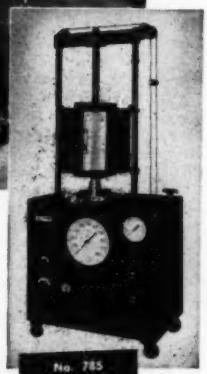
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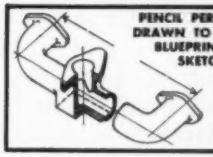
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